

Axiomat

Operating Instructions

2

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Some of the illustrations show numbered parts. The number refers to the page on which the part appears with closer description.

The illustrations are not binding in every detail.

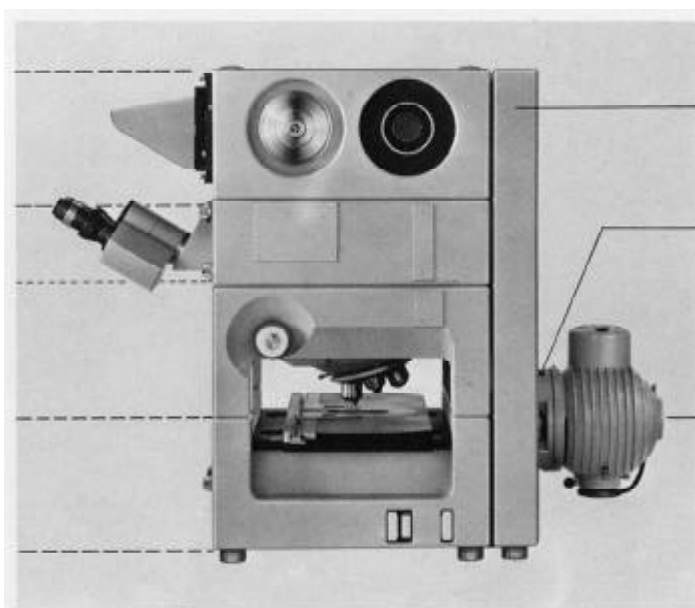
AXIOMAT NDC, ordinary upright transmitted light microscope with camera

4×5"/35 mm camera
47 56 20 (page 23)

Observation module
47 56 10 (page 17)

Objective module 47 56 01
(page 13)

Stage module T, 47 56 30
(page 9)



Cable box 47 56 48
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Lamp holder 47 56 44
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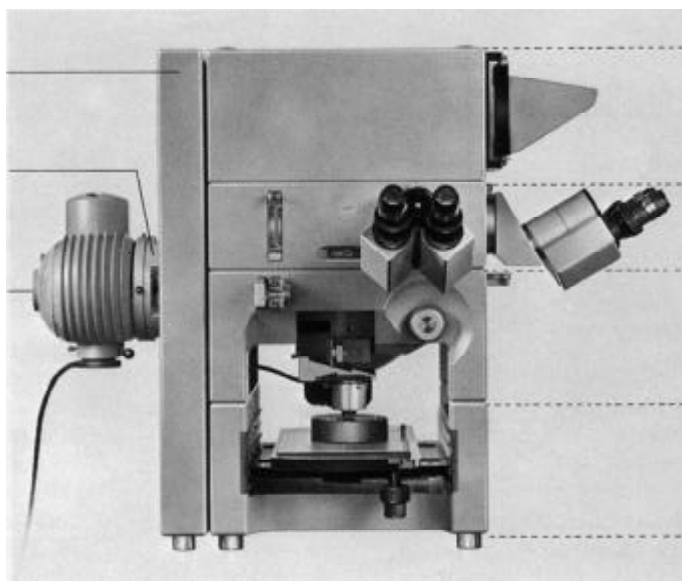
Lamp unit 250, 47 25 10
(operating instructions
G 41–320)

AXIOMAT NAC, ordinary upright reflected light microscope with camera

Cable box 47 56 48
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Lamp holder 47 56 44
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4×5"/35 mm camera
47 56 20 (page 23)

Observation module
47 56 10 (page 17)

Objective module 47 56 01
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Stage module R, 47 56 35
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AXIOMAT IDC, inverted transmitted light microscope with camera

Carrier for trans-illuminator U 475637

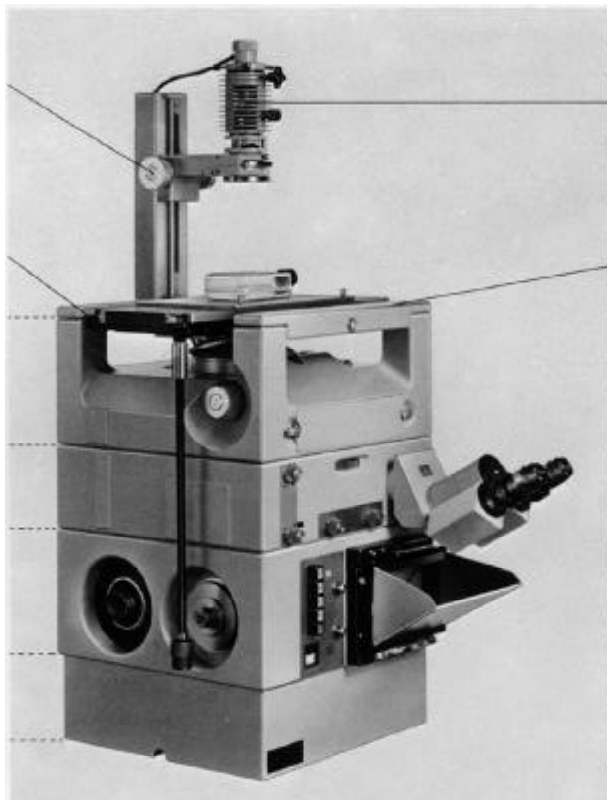
Rear stage carrier for inverted microscope

Objective module 475601 (page 13)

Observation module 475610 (page 17)

4 × 5"/35 mm camera 475620 (page 23)

Base I, 475639



Lamp unit 60 with collector and iris diaphragm

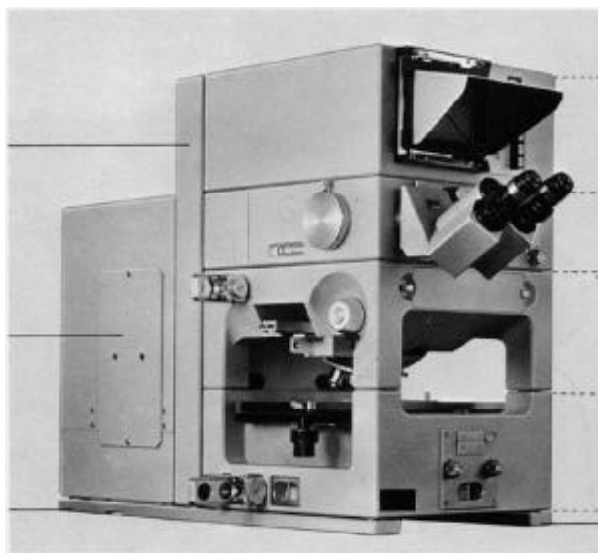
Front stage carrier for inverted microscope 465636

AXIOMAT NDC, ordinary upright transmitted light microscope with camera

Cable box 465648 (page 7)

Lamp housing 475640 (page 27)

Bars, left 465698



4 × 5"/35 mm camera 475620 (page 23)

Observation module 465610 (page 17)

Objective module 465601 (page 13)

Stage module T, 465630 (page 9)

Bars, right 475698

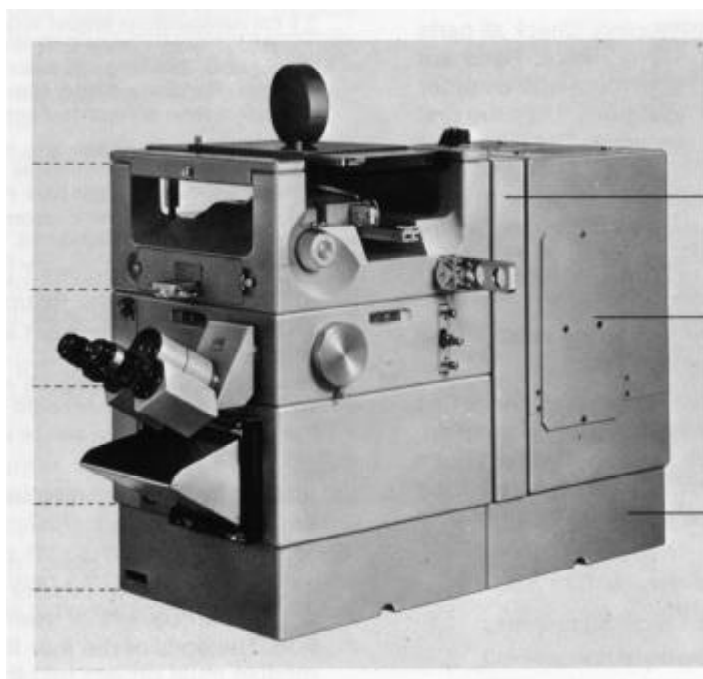
AXIOMAT IAC, inverted reflected light microscope with camera

Objective module 475601
(page 13)

Observation module
465610 (page 17)

4×5"/35 mm camera
475620 (page 23)

Base I, 475639



Cable box 475649
(page 7)

Lamp housing 475640
(page 27)

Base I, 475639

Introduction

The pictures on pp. 3 to 5 show how the main AXIOMAT configurations are assembled from the basic modules

Stage module T or R
Objective module
Observation module with binocular tube
4×5"/35 mm camera

The components are screwed together with connecting bolts of appropriate length to form a rigid block.

The **lamp unit 250**, 472510 in **lamp holder** 475644 takes one light source. If a number of different light sources have to be used in quick succession, or used simultaneously for transmitted and reflected light, use **lamp housing** 475640. For the connection of both there is a **cable box** 475648 or 475649 serving both for thermal insulation and to provide a housing for the electric cables to the camera and objective modules. For rigid connection of microscope block, cable box and lamp housing, they have

supports fitting into corresponding depressions in the two bars 475698.

The basic modules of the inverted microscope configurations are raised on to one (page 4) or two (page 5) **bases** 475639, 12 cm high to give a convenient viewing height. In this case instead of a stage module two **stage carriers for inverted microscope** 475636 are used. For transmitted light a **carrier for transilluminator U**, 475637, usually with the **lamp unit 60 with iris diaphragm** 467256, will be mounted on one of them.

The basic modules are individually packed for dispatch. The inserts and sliders with optical elements for introduction into the illumination and image forming beam path normally remain in place. Only protruding parts (binocular tube, glare shield) or delicate parts (stage, revolving nosepiece) are disassembled and separately packed.

Unpacking

Extreme care should be taken with the unpacking

Avoid rough handling of parts or dropping. Check all parts unpacked carefully against the delivery note. Parts are identified on both delivery note and invoice with an order or catalog number consisting of 10 figures. Only the first six figures are of interest for the customer. The other four after the oblique are for the manufacturer's use and help them or the supplier in the handling of enquiries. In case of enquiry, therefore, please always quote the entire identification number, e.g.

Stage module T, 475630–9901

Please give the component designation as used in this manual.

If any part listed on the delivery note is missing, check first in the packing to make sure it has not been overlooked, and do not destroy the packing material until you are quite sure the delivery is not in order. Only when you have established beyond doubt that a part is missing should you submit a complaint.

Remove before assembly

- The red transport lock of the objective motion on the objective module.
- The red threaded plugs of the light entrance and exit openings on top of the objective module and on the bottom and top surfaces of the observation module, and the red foil on the bottom surface of the camera.
- All plastic dummy plugs in the fitting bores.
- The large cover of the entrance opening for the illuminating beam path on the rear of the objective module, if any.

Assembling the microscope block

1. Place the bottom module on the working table.

1.1 For configurations **without** lamp housing 475640, stage module T, 475630, stage module R, 475635, or base I, 475639 are placed on the table. Each stage module rests on four cylindrical metal supports. The plastic dummy plugs in the fitting bores of the bottom surface serve as supports of base I.

1.2 For configurations **with** lamp housing 475640 fit the supports of stage modules T or R into the corresponding recesses of the left and right bars 475698–9901. For configurations resting on base I 475639–9901, screw a second base I to the first by using the corresponding through-bores, threaded holes and 1 screw each.

2. Provided stage modules T (see page 9) or R (see page 26) are used as bases, mount the stage.

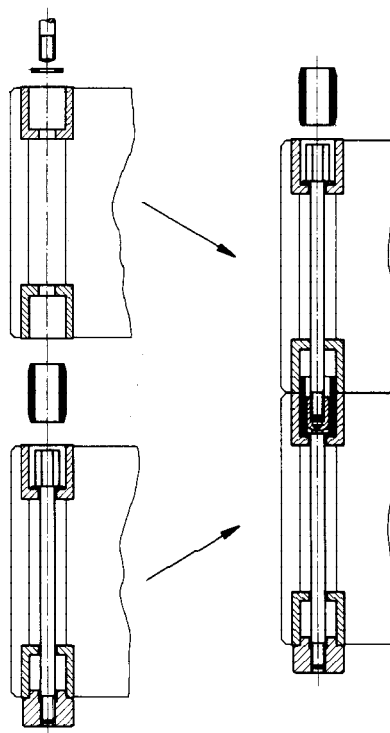
Fix the stage on stage module T with one socket head cap screw in each corner.

Slide the stage into those guide rails of the stage module R which correspond to the specimen height.

The stage can, therefore, also be exchanged when the instrument is assembled.

3. Insert one fitting sleeve into each of the four fitting bores.

4. Attach the next basic module (objective module 475601, pp. 3–5 or camera module 475620) in correct position for upright or inverted microscope configuration. The ends of the four fitting sleeves of the bottom module must project into the fitting bores of the next.



Insert one rubber sealing plug each (dust protection) between objective module and observation module and between observation module and camera module. These plugs are included in the tool kit. Their cylindrical part is pressed into the openings 13.3 and 17.1 for the image-forming beams.

5. Insert one long tension bolt with washer each into the four upper fitting bores, screw in by hand, and **tighten slightly** with the socket wrench.
6. Stack further modules in correct position for the selected microscope configuration, and connect them with the corresponding tension bolts in the manner described above.
Complement AXIOMAT IDC (page 4) and IAC (page 5) by the two "stage carriers for inverted microscope", 475636 as follows:
7. To mount the stage carrier for inverted microscopes 475636 place the guideways on 2 supports each of the objective module. The cylinders at the two ends of the carrier must fit into the fitting bores of the supports. Fix it with the socket head cap screws M10×22 (the corresponding wrench is included in the tool kit).

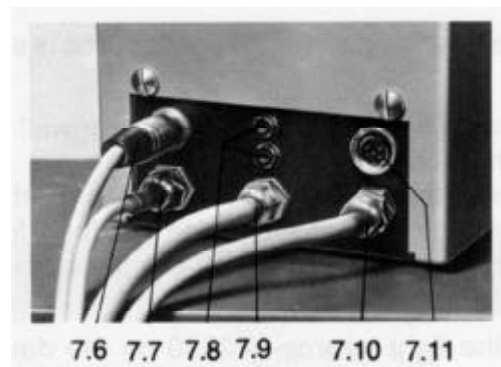
Mounting the cable box

1. Unscrew the clamping bolts and remove the rear wall of the cable box.
2. Fix the cable box 475648 or 475649 (page 5) to the side of the microscope block with the entrance openings for the illuminating ray path, with the spring socket head cap screws.
When the bars 475698 (page 4, Fig. below) are used, the supports of the cable box project into corresponding depressions in the bars. Remove the supports and locking bolts of base I, 475639 with the two pin wrench; alignment by means of the clamping bolts is sufficient.
3. Plug in the cable connecting control unit and microscope block.
4. Connect loose cable 7.2 connecting camera module and power supply unit, to the camera. Screw cover to cable box.
Lay cables so that they run downward to the right or left of the two ray path channels and come out at the rear below the cover.



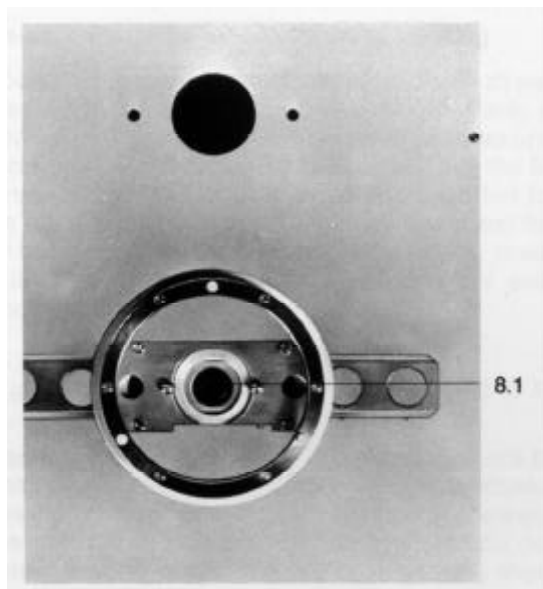
Cable box, rear wall removed

- 7.1 Connection from 7.10
- 7.2 Connection to power supply unit 29.8
- 7.3 Connection to 7.6
- 7.4 Ray path channel for transillumination. When the lamp housing (page 28) is used, a heat-protection filter KG 01, 475960 can be inserted here.
- 7.5 Ray path channel for reflected light.



Control unit 475690

- 7.6 Connection to 7.3
- 7.7 leading to 29.10 on power supply unit
- 7.8 Connection for auxiliary illumination, 6V 0.8A
- 7.9 leading to 29.9 on power supply unit
- 7.10 Connection to 7.1
- 7.11 Connection for remote control, foot switch or pulse generator. For exposure release these elements operate like pushbutton A, 24.17 or 29.5.



Lamp holder 475644 for lamp unit 250 in front of transmitted light opening on the rear wall of the cable box. The filter slider 475800 (page 10) is inserted in the holder. Heat-protection filter e.g. 467930 fits into opening 8.1.

Mounting the light source

Lamp unit 250, 472510

Use this item when one single light source is sufficient for your work.

1. Mount lamp holder 475644 on the rear wall of the cable box with 2 socket head cap screws.
For transmitted light work mount it in front of the light entrance opening of the stage module, for reflected light work in front of the light entrance opening of the objective module (page 3).
2. Mount the light source 472510 on the dovetail of the lamp holder 475644 and clamp it.

Lamp housing 475640

Use this item for rapid interchange between max. three different light sources, or for the simultaneous use of two equal or different light sources for reflected and transmitted light.

1. Place the lamp housing near the cable box behind the microscope block.
Both are rigidly connected
a) by the bars 475698 (page 4, Fig. below) for an upright microscope configuration

b) by the use of a second base I, 475639 (Fig. page 5) which is screwed to the rear of the base beneath the microscope block for an inverted microscope configuration.

With the upright microscope on bars 475698 the four supports of the lamp housing fit into the corresponding depressions in the bars.

2. Level the instrument with the adjustable supports at the end of the bars until it stands perfectly firm.
3. Lamp housing on second base I

Unscrew the supports of the lamp housing with the connecting bolts with two pin wrench or socket wrench (included in the tool kit).

Insert one fitting sleeve into each of the two rear fitting bores of base I₂.

Mount the lamp housing so that its two rear fitting bores slide over the fitting sleeves in the base.

Lamp unit 60 with iris diaphragm, 467256

Only for transmitted light inverted microscope.

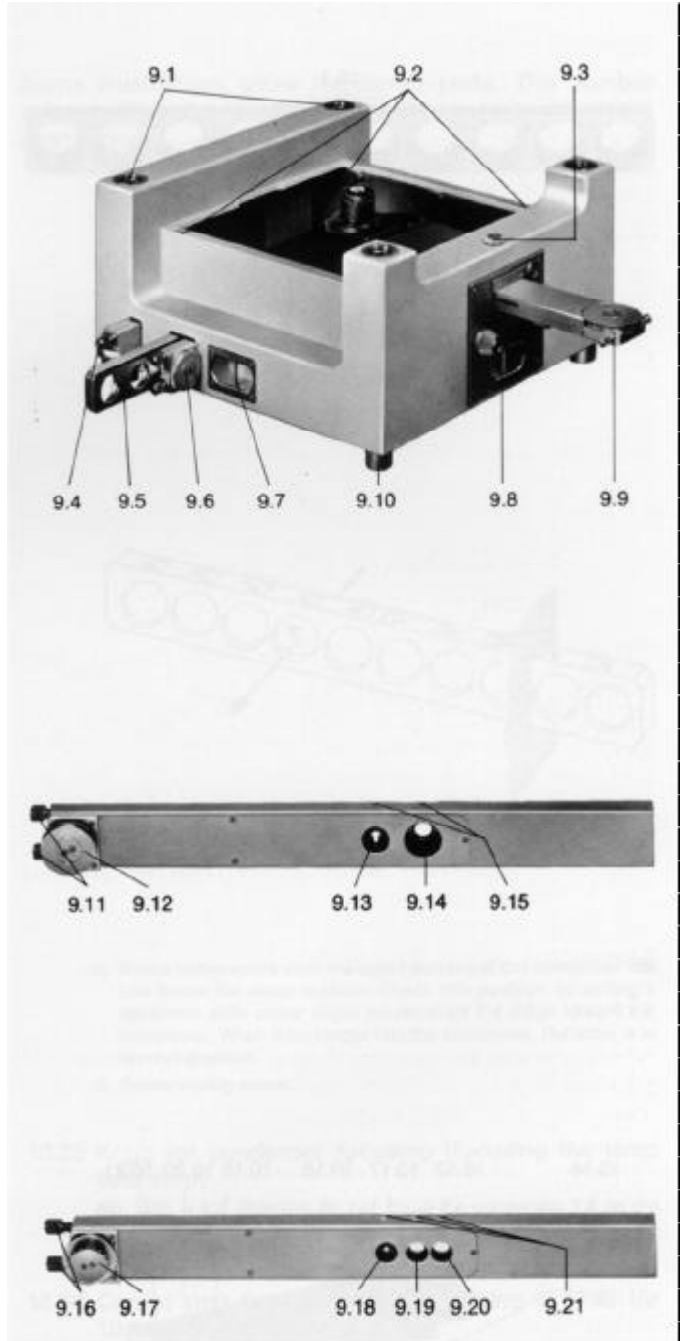
The lamp unit is vertically adjustable with rack and pinion of the carrier for transilluminator U, 475637 on which it is mounted. Fix this carrier on the stage carrier for inverted microscope, 475636 with mounting holes as follows:

1. Remove the clamping bolts and small fitting cylinders in the base of the carrier.
2. Press out the caps and plug both fitting cylinders from above into the fitting bores in the stage carrier corresponding to the mounting holes.
3. Mount the carrier for the transilluminator U so that the fitting cylinders engage its fitting bores.
4. Screw the clamping bolts from below through the stage carrier and tighten with hexagon head socket wrench.
5. Insert the lamp housing 60, 467256 into the upper dovetail of the carrier by pressing back the clamping spring screw with its dovetail until the dovetail can be completely inserted. Tighten the cap of the clamping screw.
6. Insert lamp socket 60, 468015, with filament lamp 12V 60W from above into the lamp housing and clamp it.

Basic modules

Stage module T 475630

- 9.1 Fitting bores
- 9.2 Threaded points of support for the specimen stages (mechanical stage 475655, rotary Pol stage 475660), page 12
- 9.3 Clamping screw for the zoom condenser
- 9.4 **Aperture diaphragm slider** 475705, see below
- 9.5 **Filter slider** 475800, page 10
- 9.6 **Lamp field stop slider** for zoom condenser 475701, see below
- 9.7 **Mirror insert** 475721 for zoom condenser
must always be inserted right to the stop to avoid adjusting errors of the illumination.
- 9.8 **Zoom condenser insert** 475731, page 10
- 9.9 **Transmitted light polarizer** 475810, page 16
- 9.10 Supports



Lamp field stop slider 475701 for zoom condenser

- 9.11 Centering screws which act simultaneously on the diaphragms 9.13 and 9.14
- 9.12 Knurled knob for adjusting the size of the lamp field iris diaphragm 9.13
- 9.13 Lamp field iris diaphragm
- 9.14 Opening for fixed stops, e.g. straylight cut-off diaphragms for photometry
- 9.15 Catches

Aperture diaphragm slider 475705

- 9.16 Centering screws which act on the diaphragms 9.18, 9.19 and 9.20
- 9.17 Knurled knob for adjusting the size of the aperture iris diaphragm 9.18
- 9.18 Aperture iris diaphragm
- 9.19 Phase contrast annular diaphragm
- 9.20 Opening for a special diaphragm, e.g. for oblique illumination
- 9.21 Catches

Both diaphragm sliders can be inserted from the left or from the right into the stage or the objective module. The tip of the colored triangle must always point to the dot of the same color on the stage module. The iris diaphragm is in the illuminating ray path when the sliders are inserted to the stop.

Pull out the slider by 1 or 2 stop positions when one of the other openings or diaphragms is to be brought into the ray path.

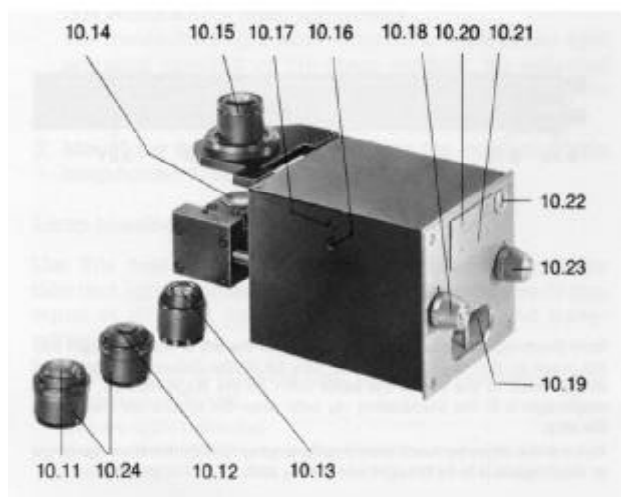
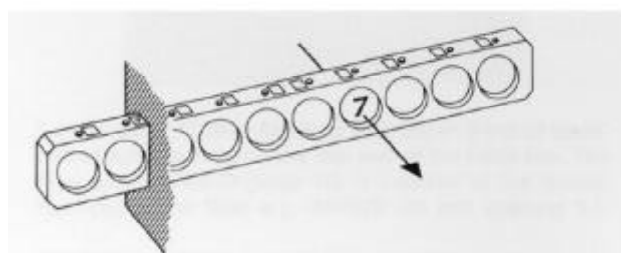
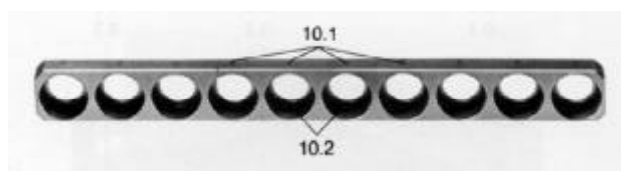
Filter slider 475800

10.1 Catches

10.2 Snap rings to fix the filters.

Insert the filter slider from the left or from the right into the base like the lamp field stop or aperture diaphragm sliders. The catches must lie **on top**, and the tip of the black triangle must point to the black dot. The slider has 10 openings for filters of 32 mm dia. or for filter combinations. The filters are fixed by snap rings (10.2). One catch (10.1) corresponds to a filter opening. For better identification of the filter in the ray path from the outside, paste labels with the filter designation next to the catches (see opposite drawing), so that the designation of the filter in the ray path is always next to the wall of the housing.

As the user selects the filters and their arrangement, the identification cannot be made by the manufacturer, although the labels are provided (page 51).



Zoom condenser insert 475731

10.14 Zoom system

10.15 Condenser 1.4

10.16 Stop screw for transmitted light polarizer

10.17 Stop screw for differential interference contrast (DIC) condenser slider

10.18 Knob for adjusting the zoom system:

With the condenser 1.4 set the objective magnification on the chromium plated ring of the knob below the index dot. The color of the figures corresponds to that of the index rings on the objectives. With the two darkfield condensers, set the letter D on the ring below the index dot.

10.19 Handle to remove the insert

To avoid damage to the condenser 10.15 when inserting or removing the insert on stage module T 475630 (page 9), exchange is possible only when the condenser is brought in lowest position with knob 10.23. Slide the insert in until it engages, and fix it with clamping screw 9.3.

Some illustrations show numbered parts. The number refers to the page on which the part appears with closer description.

10.20 Cover plate for the opening of the DIC condenser slider with two DIC illuminating prisms 475850 (33.1). Insert like 10.21.

10.21 Cover plate for the opening of the **transmitted light polarizer** 475810 (page 16)

- Remove cover plate 10.21:

- Unscrew stop screw 10.16 so that the polarizer can be completely inserted; with 10.23 move the condenser into uppermost position. Set the slider in middle position, and

- Screw in the stop screw. The slider moves smoothly back and forth between the two stop positions, except for a slight resistance shortly before the stop position is reached.

Proceed in the same manner when inserting the DIC slider.

Pull out the slider to the stop when lowering the condenser with knob 10.23, to remove the insert 10.19, for instance.

10.22 Locking screw for condenser stop

During vertical adjustment this stop prevents the condenser from pushing through the stage and lifting the specimen. Adjust this stop so that the upper edge of the condenser lies approx. $\frac{1}{10}$ mm below the stage surface. If this is not the case, re-adjust as follows:

a) Unscrew lid 10.22 which gives access to a socket head cap screw M 4.

b) Unscrew this screw with screwdriver M 4 until the condenser in uppermost position projects from the stage opening over the stage surface.

c) Screw in the screw until the upper surface of the condenser lies just below the stage surface. Check this position by sliding a specimen slide under slight pressure on the stage toward the condenser. When it no longer hits the condenser, the latter is in correct position.

d) Screw in plug screw.

10.23 Knob for condenser focusing (focusing the lamp field stop)

NB: With a 5× objective do not focus the condenser 1.4 on the lamp field stop, but set the number 5 on its ring below the index dot.

10.24 Carrier ring for darkfield condensers 475740 for 10.11 and 10.12

Mounted instead of the brightfield condenser 10.15.

10.11 Dry darkfield condenser 0.8/0.95, 465505

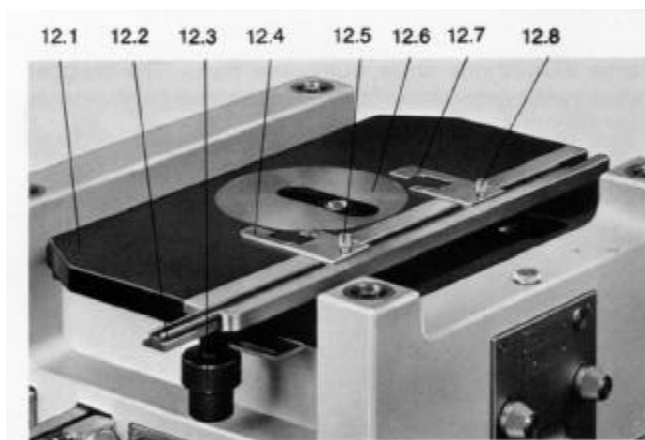
for Planapochromat 25/0.65. On carrier ring 10.24 both darkfield condensers can be mounted instead of the brightfield condenser.

10.12 Ultra condenser 1.2/1.4, 465500

for Planapochromat 50/0.95 and 50/1.0, and, with plug-on diaphragm, for Planapochromat 100/1.30.

10.13 Phase contrast condenser 0.9, 465293

If illuminating apertures above 0.9 are not required, it can also be used for brightfield.



Mechanical stage 47 56 55 on stage module T

- 12.1 **Mechanical stage 47 56 55**
- 12.2 Dovetail for insertion of specimen holder or specimen plate
- 12.3 Short coaxial drive
- 12.4 **Specimen clip left, 47 59 01**
- 12.5 Locking screw
- 12.6 **Stage insert D, 47 59 40**
- 12.7 **Specimen clip, right, 47 59 00**
- 12.8 Locking screw

After loosening the locking screws, the specimen holders 12.4 and 12.7 can be moved back and forth in the dovetail 12.2.

The following specimen plates can be inserted instead of the specimen holders:

Specimen plate D, 47 59 04 for the rapid exchange of specimen slides (26×76 mm).

Specimen plate A, 47 59 05, a smooth plate without opening for the reflected-light examination of specimens.

Specimen plate UM, 47 59 09 to place polished sections on an inverted metallograph, with 2 inserts of 24 and 28 mm opening dia. (47 59 43 and 47 59 44).

Specimen frame UPL, 47 59 03 for chambers and specimen slides 26×76 mm on the inverted transmitted light microscope.

Special holders can be made from 47 59 05.

The coaxial drive can be provided to the right or to the left. Call for the maintenance technician when it is to be exchanged. The x-motion of the stage can be provided to the front (see Fig.) or to the rear, and the drive on either side, front or rear. The stage is supported in four points (9.2), fixed by 4 socket head cap screws M 4. The stages are screwed to the stage modules when leaving the factory.

Remove or exchange the stage before mounting other modules, and always remove the revolving nosepiece with the objectives when the instrument is assembled.

Rotary polarizing stage 47 56 60

- 12.10 Stage plate
- 12.11 Rotary centerable stage plate with graduated periphery
- 12.12 Left recess for screw driver M 4 to center the stage.
Another recess is provided on the right side.
- 12.13 Openings for M 4 clamping bolts
- 12.14 Insert A, 47 59 41
- 12.15 Vernier to read the graduation
- 12.16 Clamp for 45° click stop ring

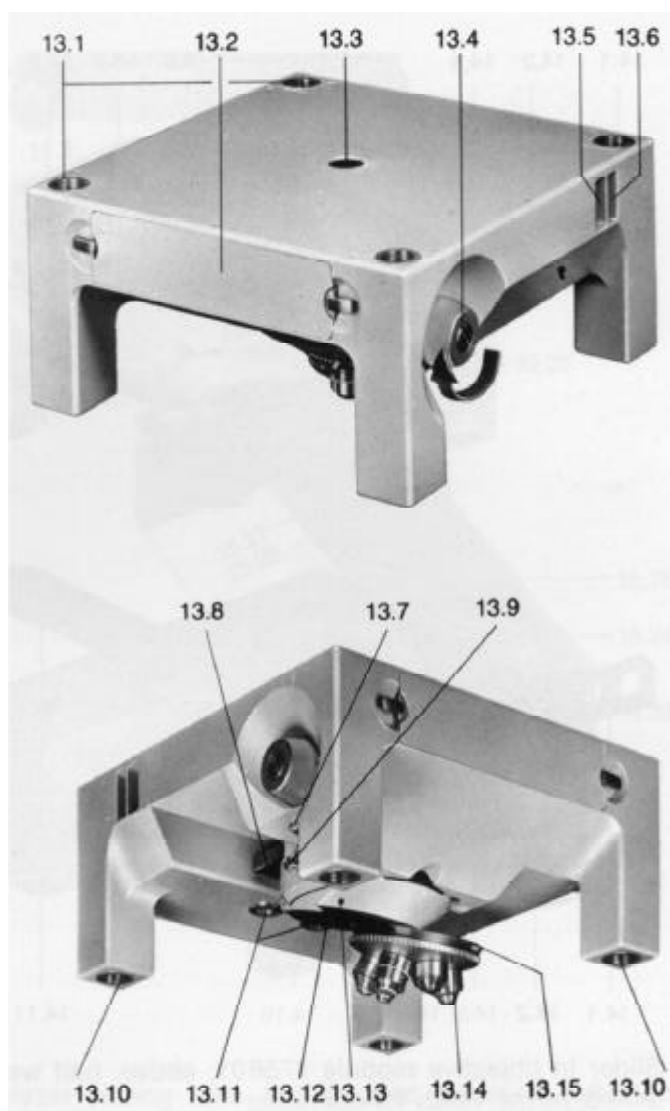
Clamp loosened = click stops by-passed; clamp tightened = click stop ring connected with stage; click stops every 45°.

To the left (not shown in the picture) there is another clamp to slow down or stop the stage rotation.

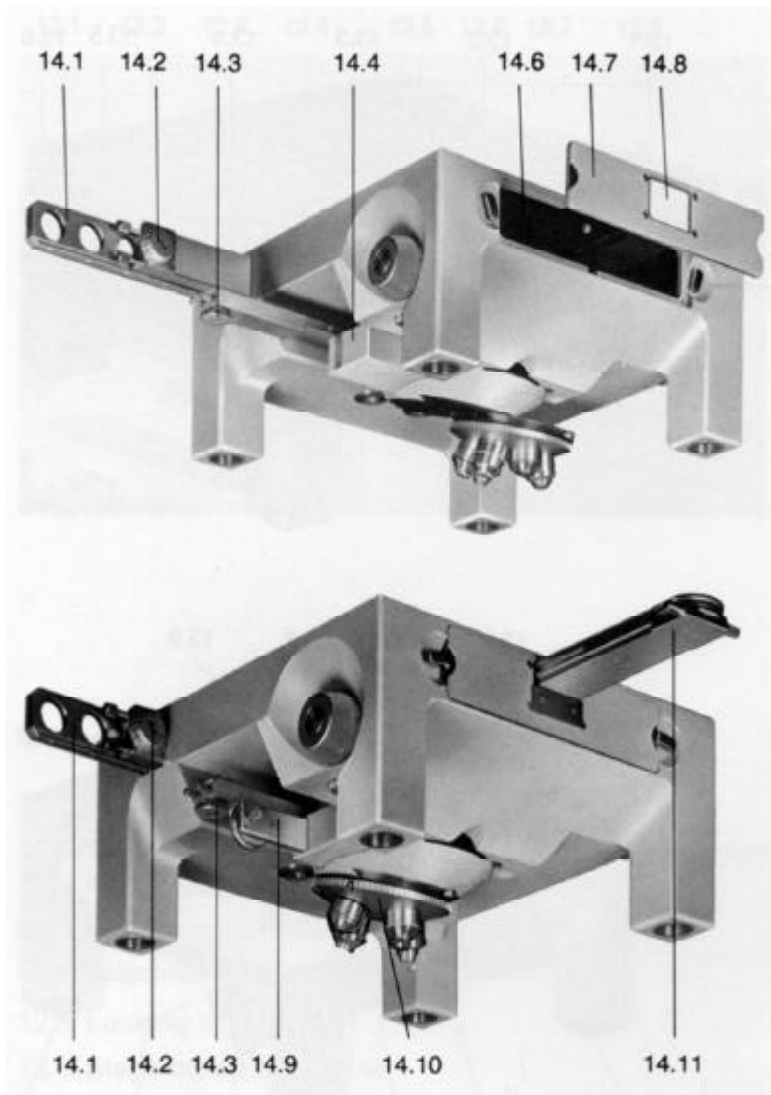
Rotary polarizing stage is described in brochure GE 41 –190.2–e.

Objective module 475601

- 13.1 Upper fitting bores
- 13.2 Cover plate for the opening of the **analyzer sliding tube** 475760 (page 15), the **reflected light mirror** 475759.
- 13.3 Opening for imaging ray path
- 13.4 Knob for manual precise focusing (provided to the right and to the left). Turning the knob in the direction of the arrow brings the objective nearer to the specimen. One interval of the graduation on the knob corresponds to a vertical shift of the objective of $1\text{ }\mu\text{m} = 0.001\text{ mm}$.
- 13.5 Right opening for the aperture diaphragm slider 475705 for reflected light
- 13.6 Right opening for the filter 475800 for reflected light.
Both sliders correspond to those for transmitted light (pp. 9 and 11).
- 13.7 Knob to shift the focusing limit switch.
With this knob a limit switch is brought to a stop in the focusing drive so that during electrical focusing the objective stops automatically in the adjusted position of the limit switch. This protects specimen and objective and facilitates re-locating the focusing plane.
To adjust the focusing stop:
● focus on the specimen image
● turn knob 13.7 clockwise in arrow direction to the stop.
- 13.8 Opening for lamp field stop slider for reflected light 475710
- 13.9 Slider covering the opening for the following items (turn back stop screw 13.13 until the guideways are free):
Reflector HPI-Pol + D, 475755 for brightfield/dark-field reflected light microscopy,
Reflector FI, 475756 for epi-fluorescence excitation,
Barrier-filter slider, 475801 for transmitted light fluorescence excitation,
Auxiliary object slider, 475830 containing $\lambda/4$ plate, retardation plate first order red, and a movable quartz wedge $0-2\lambda$ for polarizing microscopy,
Flatfield objectives $1.25\times$ and $2.5\times$ in slider 462201,
EPIPLAN objectives $1.25\times$ and $2.5\times$ in HPI reflector slider 462231.



- 13.10 Lower fitting bores
- 13.11 Auxiliary illumination, operated with switch 29.4 on control unit
- 13.12 Dovetail for revolving nosepieces (page 16) on the objective guide carrier for the focusing motion
- 13.13 Stop screw for click-stop positions of the sliders at 13.9
- 13.14 **Sixtuple revolving nosepiece**, 475609 with 6 objectives, half way inserted
- 13.15 Spring stop pin on sixtuple revolving nosepiece. Insert revolving nosepieces so that this pin points toward the user.



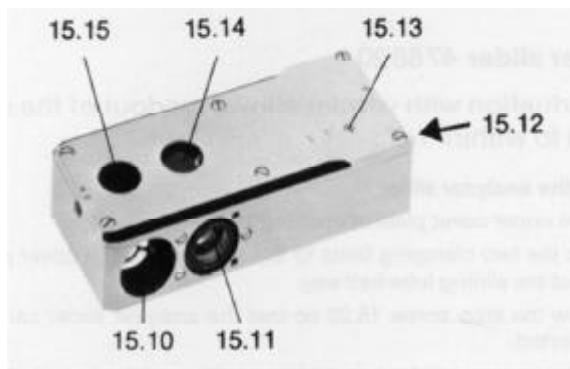
Slider in objective module 475601; above: half way inserted, below: ready for operation

- 14.1 **Filter slider** 475800, page 10
- 14.2 **Aperture diaphragm slider** 475705, page 9
- 14.3 **Lamp field stop slider** for reflected light 475710, page 15
- 14.4 **Reflector HPI-Pol+D**, 475755, page 15
- 14.6 Analyzer sliding tube 475760, page 15
- 14.7 Cover plate for sliding tube
- 14.8 Upper opening for analyzer slider 475820, page 16
Lower opening for **tilting quartz compensator**, 475840 to measure path differences in birefringent specimens,
tilting calcite compensator, 475845 for quantitative polarizing microscopy
- 14.9 Reflected light polarizer 475815, page 16
- 14.10 **Quadruple revolving nosepiece**, 475608 with one fixed and three centerable objective sockets especially for polarizing microscopy, page 16
- 14.11 **Analyzer slider** 475820, page 16

Lamp field stop slider for reflected light, 475710

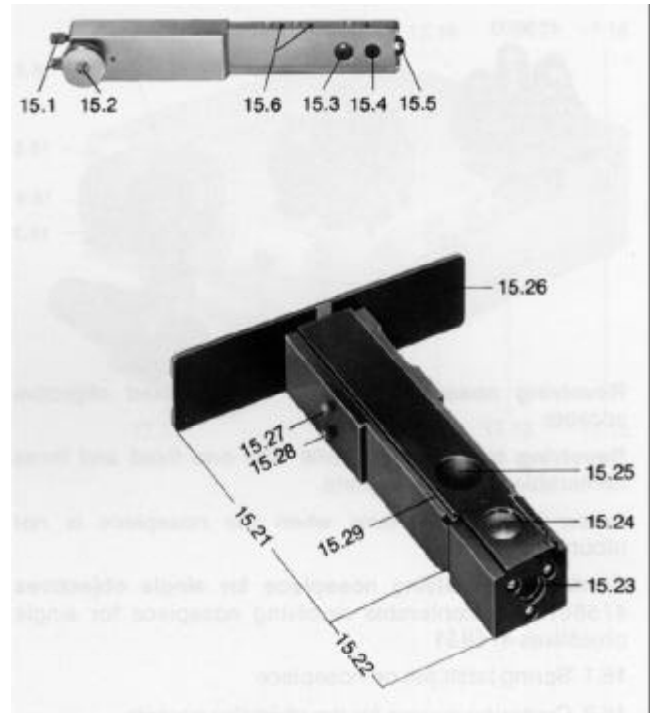
Make sure that this lamp field stop is in the illuminating ray path of the objective module only with incident brightfield illumination. Pull it out to the last (third) click stop with darkfield illumination.

- 15.1 Centering screws, act simultaneously on the diaphragms 15.3 and 15.4
- 15.2 Knurled knob to change the size of the lamp field iris diaphragm 15.3
- 15.3 Lamp field iris diaphragm
- 15.4 Opening for fixed stops such as straylight cut-off diaphragms for photometry
- 15.5 Inserted special diaphragm
- 15.6 Catches



Reflector HPI + D 475755

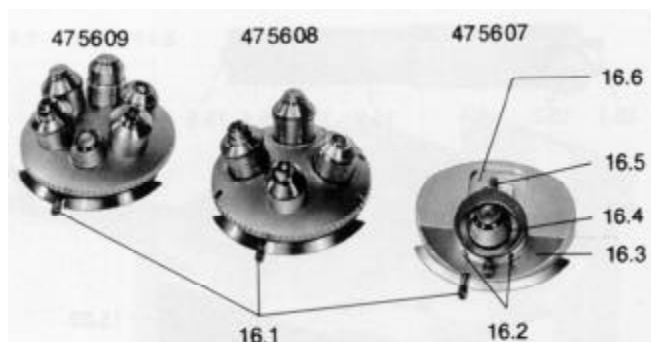
- 15.10 Light entrance opening for darkfield illumination
- 15.11 Light entrance opening for brightfield illumination
- 15.12 Cover plate for opening of **reflected light polarizer** 475815, page 16
- 15.13 Stop screw for **reflected light polarizer**
 - Inserting the reflected light polarizer**
 - a) Remove cover plate at 15.12
 - b) Unscrew stop screw 15.13 so far that the polarizer 14.9 can be inserted
 - c) Bring polarizer into middle position and screw in stop screw. The polarizer must smoothly move back and forth between the stop positions.
- 15.14 Opening for imaging ray path with brightfield illumination
- 15.15 Opening for imaging ray path with darkfield illumination



Analyzer sliding tube 475760 with attached **reflected light mirror** 475759

- 15.21 **Analyzer sliding tube** 475760
- 15.22 **Reflected light mirror** 475759
- 15.23 Entrance opening for reflected light beam path
- 15.24 Exit opening for reflected light beam path
- 15.25 Opening for imaging ray path with higher order white quartz plate (large path difference)
- 15.26 Cover
- 15.27 Stop screw for insert with retardation plates; not yet provided at this point
- 15.28 Stop screw for analyzer slider 472820
- 15.29 Dovetail for inserting the sliding tube into the objective module

The sliding tube is required for the analyzer slider, and as a carrier for the reflected light mirror 475759 which deflects the light entering the objective module through filter slider and aperture diaphragm, to the lamp field stop. Behind the lamp field stop the illuminating beams are directed to the reflector HPI-Pol or D by a mirror rigidly mounted in the sliding cylinder for the focusing motion. The reflected light mirror is connected to the sliding tube with a dovetail. Like the sliding tube, the reflected light mirror remains in the instrument.



Revolving nosepiece 475609 with 6 fixed objective sockets

Revolving nosepiece 475608 with one fixed and three centerable objective sockets

Screw in the objectives when the nosepiece is not mounted.

Carrier for revolving nosepiece for single objectives 475607 with centerable revolving nosepiece for single objectives 475951

16.1 Spring latch pin on nosepiece

16.2 Centering screws for the objective sockets

16.3 Carrier for revolving nosepiece for single objectives 475607

16.4 Centerable revolving nosepiece for single objectives 475951

16.5 Safety cap.

Loosen before centering and tighten slightly after centration of the objective.

16.6 Recess for insertion of the revolving nosepiece for single objectives.

When the angle of rotation is 0° , the **vibration direction** of polarizer and analyzer is East–West. When both vibration directions are crossed, the analyzer is in 90° position.

16.10 Handle

16.11 Handle and clamping screw to clamp the analyzer rotation

16.12 Knurled knob for polarizer rotation

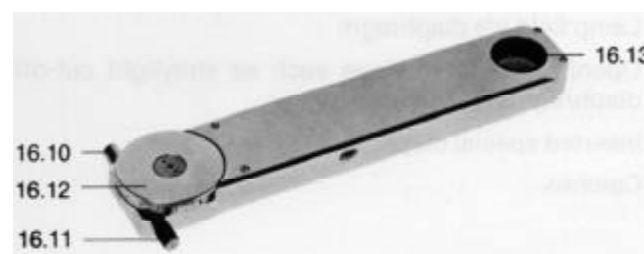
16.13 Filter polarizer rotatable through 360°



Transmitted light polarizer 475810

For the insertion of this polarizer see page 11.

One interval of its graduation corresponds to 5° , with a click stop after each rotation through 90° .

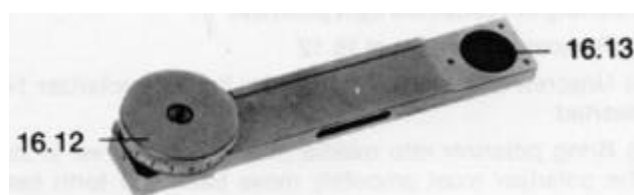


Analyzer slider 475820

The graduation with vernier allows readout of the angle of rotation to within $1/10^\circ$.

Inserting the analyzer slider

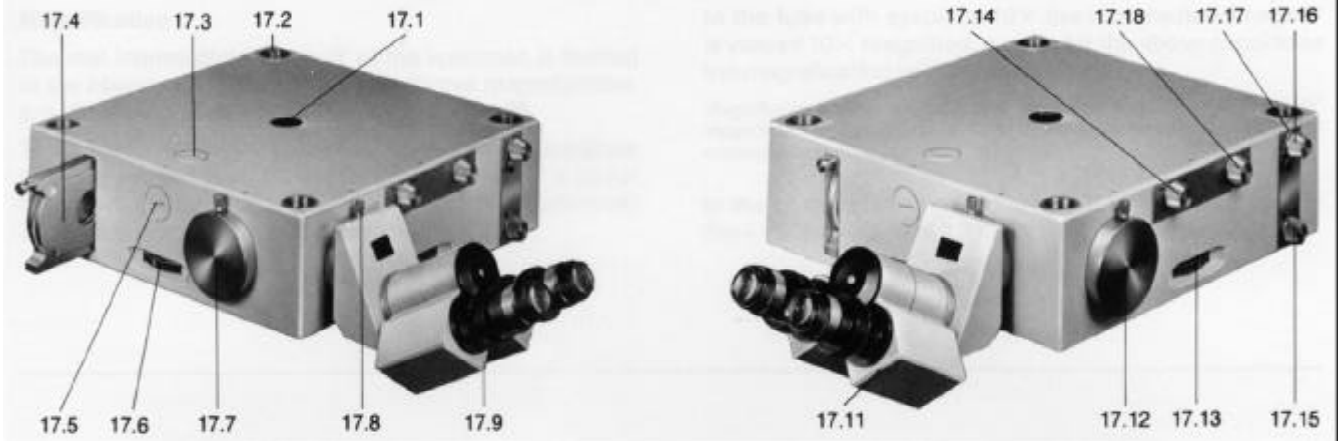
- Remove upper cover plate of opening 14.8
- Loosen the two clamping bolts to the right and left of cover plate 14.7, and pull out the sliding tube half way.
- Unscrew the stop screw 15.28 so that the analyzer slider can be completely inserted.
- Bring the analyzer slider into middle position, and screw in stop screw. The slider moves smoothly back and forth between the two stop positions except for a slight resistance shortly before the stop position is reached.



Reflected light polarizer 475815

For insertion see page 15. It is provided with graduation without vernier.

Observation module 475610



- 17.1 Opening for imaging ray path
- 17.2 Fitting bore
- 17.3 Cover for observation window of photometer image
- 17.4 **Slider with reticle turret** (page 22)
- 17.5 Cover for lateral image deflection (page 21)
- 17.6 Knurled knob for switching beam splitter II (page 19)
- 17.7 Covered circular dovetail for co-observation tube
- 17.8 Clamping screw for tube
- 17.9 **Binocular tube 1**, 475619
- 17.11 **Binocular tube 2**, 475619
- 17.12 Circular dovetail for tube I (17.9), covered
- 17.13 Knurled knob for switching beam splitter I (page 19)
- 17.14 Knob for switching beam splitter III
- 17.15 Knob to swing the auxiliary objective (Bertrand lens) in or out
- 17.16 Knob to focus the auxiliary objective (Bertrand lens) on the objective exit pupil
- 17.17 Ring to operate the aperture iris diaphragm in the auxiliary objective 17.15
- 17.18 Knob for setting the zoom OPTOVAR

Functions of the observation module 475610

Its main functions are:

- 1) It forms two successive real intermediate images of the image produced by the objective at infinity, or a real intermediate image of the pupil. The real intermediate images are easily **accessible from the outside**, and the imaging from the first into the second intermediate image plane is continuously changed at a ratio of 1:4.
- 2) It transmits the two intermediate images into one or two binocular tubes for observation, or into the 4×5"/35 mm camera (page 23), a cine camera, or a projection attachment, for photographic recording, or into a photometer with 35 mm camera for photometric measurement and photographic recording.

The „zoom OPTOVAR“ pancratic system between the two intermediate image planes changes the magnification continuously between the two intermediate images. The image remains in focus over the entire range.

The images can be produced at any desired point with three built-in beam splitters which are operated from the outside and consist of a special prism for each function, mounted on a carrier which is rotatable around its axis. The various functions are indicated by symbols on the outside. The drawings on pp.19–21 illustrate the most important functions of these beam splitters. For a better understanding only the operative prisms are shown.

Sliders with reticles or other measuring and viewing aids can be inserted into the two intermediate image planes, are superimposed on the specimen image and can be viewed or recorded together with the specimen.

The observation module contains in front of the intermediate image O' a swing-in auxiliary objective (Bertrand lens) to observe the objective pupil and phenomena (polarizing microscopy).

The focusing objective with (Bertrand) iris diaphragm lies in a plane which is optically conjugate with the specimen plane so that small areas in the center of the specimen image can be isolated. This selected area determines the light distribution in the objective opening. Light which has passed through other areas does not interfere with the “conoscopic interference image” of small crystals in polarized light.

Magnification

The real intermediate image $0'$ of the specimen is formed in the observation module at the objective magnification, e.g. $25\times$ magnified with a Planapochromat 25.

The zoom OPTOVAR produces from this intermediate image a second one, $0''$, which is magnified by a factor between $0.8\times$ and $3.2\times$, e.g. $20\times$ with a Planapochromat 25 and a factor of $0.8\times$ of the zoom OPTOVAR.

In the tube with eyepiece $10\times$ the intermediate image $0''$ is viewed $10\times$ magnified, e.g. under the above conditions the magnification will be $20\times 10\times = 200\times$.

Magnifications exceeding $20\times$ the objective magnification are "empty" magnifications, though they may be of use for geometric or photometric measurements.

In the camera intermediate image $0''$ is magnified $10\times$ in the $4\times 5''$ camera, and $3.2\times$ in the 35 mm camera.

Functions of the beam splitters

In the inverted microscope configurations AXIOMAT IDC and IAC the observation module is upside down. The symbols are then $\rightarrow$ instead of $\leftarrow$, for instance.

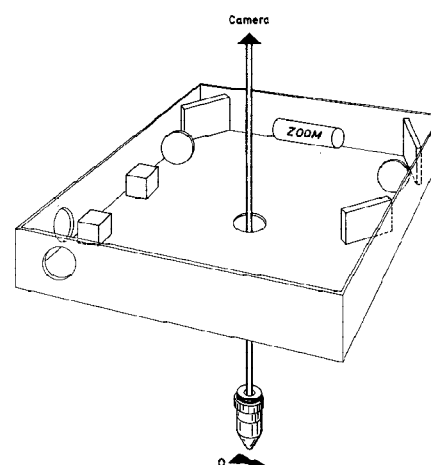
19.1

Beam splitter I (17.13): $\uparrow$

Beam splitter II (17.6): inoperative

Beam splitter III (17.14): inoperative

An image of the specimen is produced in the camera at the fixed magnification = objective magnification $\times 10$ ($4\times 5''$) or $\times 3.2$ (35 mm) camera.



19.2

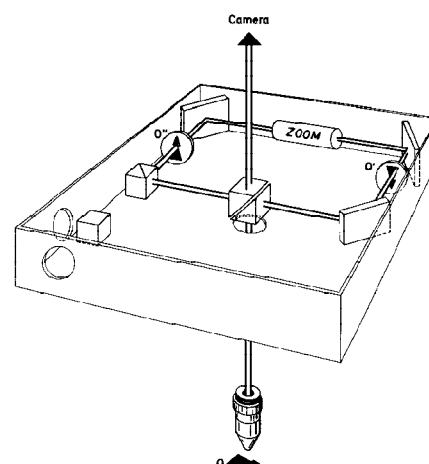
Beam splitter I (17.13): $\leftarrow$

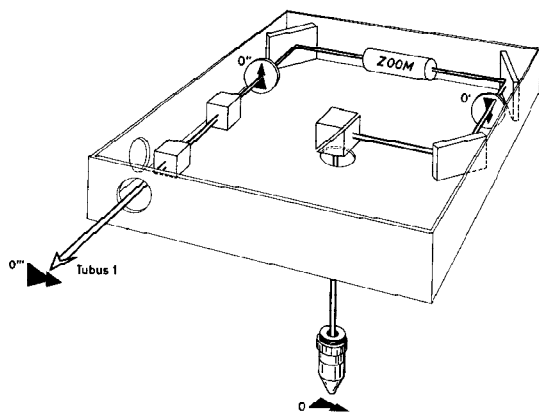
Beam splitter II (17.6): $\uparrow$

Beam splitter III (17.14): inoperative

An image of the specimen is produced in the camera via intermediate image $0'$, zoom OPTOVAR and intermediate image $0''$.

During photometry the measuring area with the diaphragms is observed through the tube.

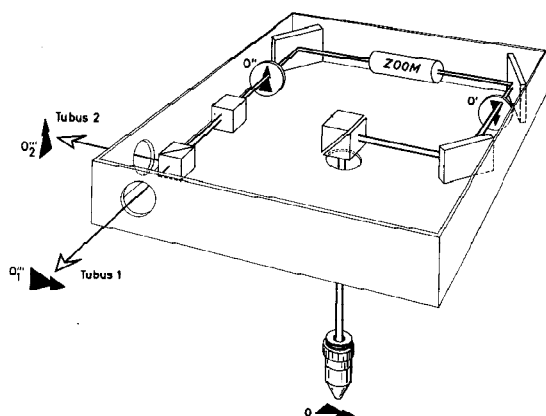




20.1

Beam splitter I (17.13): ←
 Beam splitter II (17.6): →
 Beam splitter III (17.14): ●

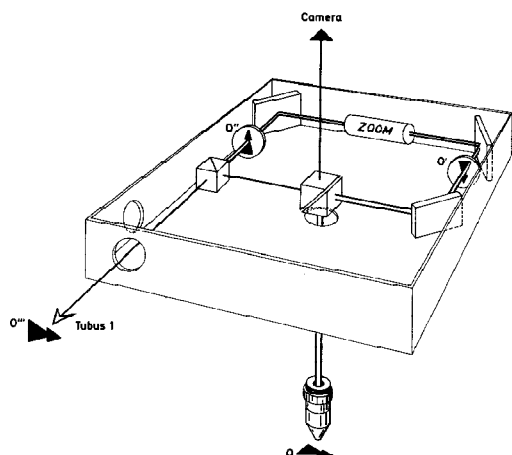
The image of the specimen is formed in tube 1.



20.2

Beam splitter I (17.13): ←
 Beam splitter II (17.6): →
 Beam splitter III (17.14): ●

Like in 20.1 in tube 1, an image of the specimen of equal brightness is formed in tube 2 for a second observer.



20.3

Beam splitter I (17.13): ←
 Beam splitter II (17.6): ↗
 Beam splitter III (17.14): ●

This position is most frequently used. An image of the specimen is formed in the camera which can be viewed through tube 1 with a frame to check the camera format and for focusing.

21.1

Beam splitter I (17.13): $\leftarrow$

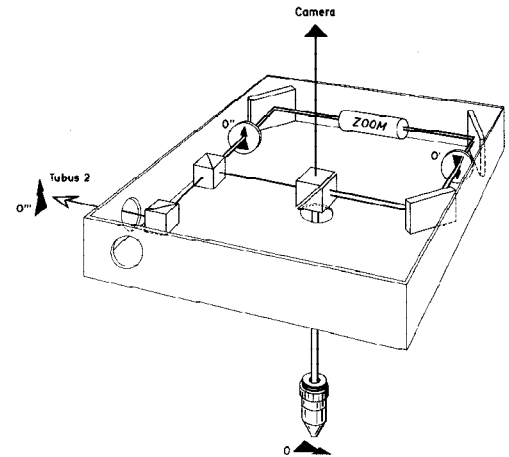
Beam splitter II (17.6): $\nearrow$

Beam splitter III (17.14): $\leftarrow$

Like in 20.3, an image is formed in the camera, but is viewed through tube 2 for focusing.

Beam splitter III: $\leftrightarrow$

Each of the two images in tubes 1 and 2 has 50% of the total brightness.



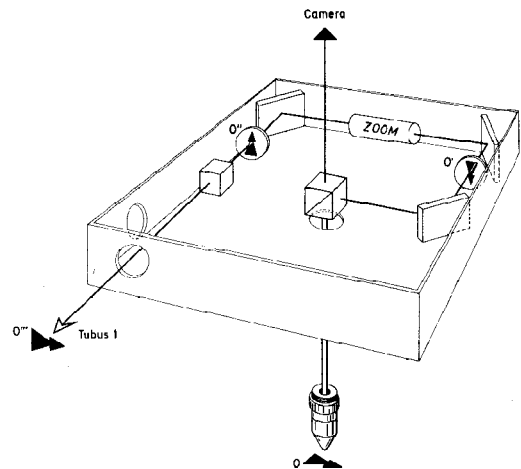
21.2

Beam splitter I (17.13): $\nearrow$

Beam splitter II (17.6): $\rightarrow$

Beam splitter III: $\bullet$ in tube 1
 $\leftarrow$ in tube 2
 $\leftrightarrow$ in tubes 1 and 2

The beams producing intermediate image $0''$ are split up by beam splitter I. As in 19.1, an image is directly formed in the camera at a fixed magnification, and simultaneously in the tube, as in 20.1, to check image section and focus. Both images coincide only when the zoom OPTOVAR is set to 1.



21.3

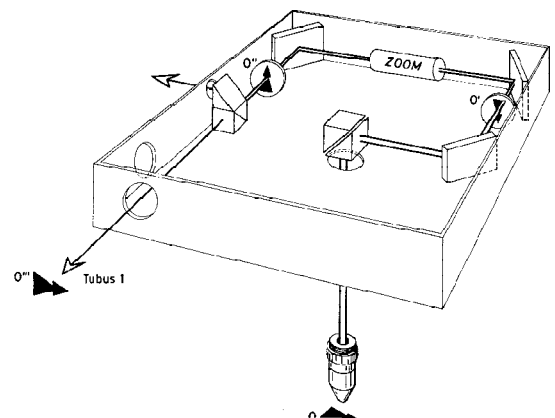
Beam splitter I (17.13): $\leftarrow$

Beam splitter II (17.6): $\rightarrow$

Beam splitter III (17.14): $\bullet$ in tube 1
 $\leftarrow$ in tube 2
 $\leftrightarrow$ in tubes 1 and 2

Part of the light forming the intermediate image at $0''$ is directed to the tube by beam splitter II, whereas most of the image forming light is deflected and leaves the observation module at 17.5.

The image of the specimen can be produced at any desired location with the aid of optical elements, e.g. in a cine camera, at TV camera, or a projection attachment.





Always **keep a reticle** (or a glass plate without reticle) in opening 17.4 to make sure that the images in the camera and in the observation tube are both in focus.

Reticle insert 475770

Insert with turret 477551 for reticles

With these inserts fixed or adjustable reticles can be brought into the second intermediate image plane 0" (pp. 19–21).

Use the insert with turret if reticles are to be rapidly exchanged, e.g. a focusing reticle and different types of crosslines as in polarizing microscopy.

The following reticles are available:

Focusing reticle 475881 framing the $4 \times 5''$ and the 35 mm formats.

Focusing reticle 475882 framing the $4 \times 5''$ format which corresponds only approximately to the 35 mm format.

All other reticles of our make of 19 mm dia. and of exactly 2 mm thickness can also be used.

Screw micrometer insert 475774

With movable index lines for length measurements in the eyepiece image, where the results are read.

Insert with pointer 475773

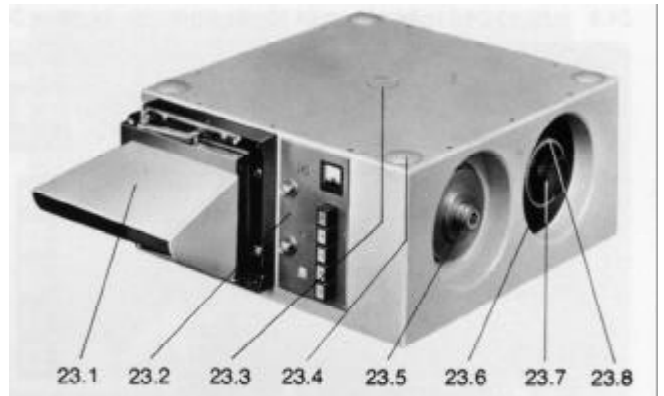
The tip of the pointer can be brought to any point within the field of view from the outside.

Microhardness measuring insert 475775

It contains the movable reference lines for measuring microhardness indentations; readout in the eyepiece image.

Camera module 475620

- 23.1 Glare shield in front of the groundglass
- 23.2 Operating panel
- 23.3 Plug for beam path opening
- 23.4 Dummy plugs for the four upper fitting bores
- 23.5 35 mm film magazine with frame counter 47 2026
- 23.6 Film speed selector for automatic exposure control
- 23.7 Setting knob
- 23.8 Setting ring



With selector 23.6 set the automatic exposure control to the speed of the photographic material in intervals of 1 DIN or the corresponding ASA value. Intervals of 3 DIN are set by turning knob 23.7 (in both directions). Turning the setting ring 23.8 clockwise or counterclockwise to the stops changes the adjusted DIN value by ± 1 DIN.

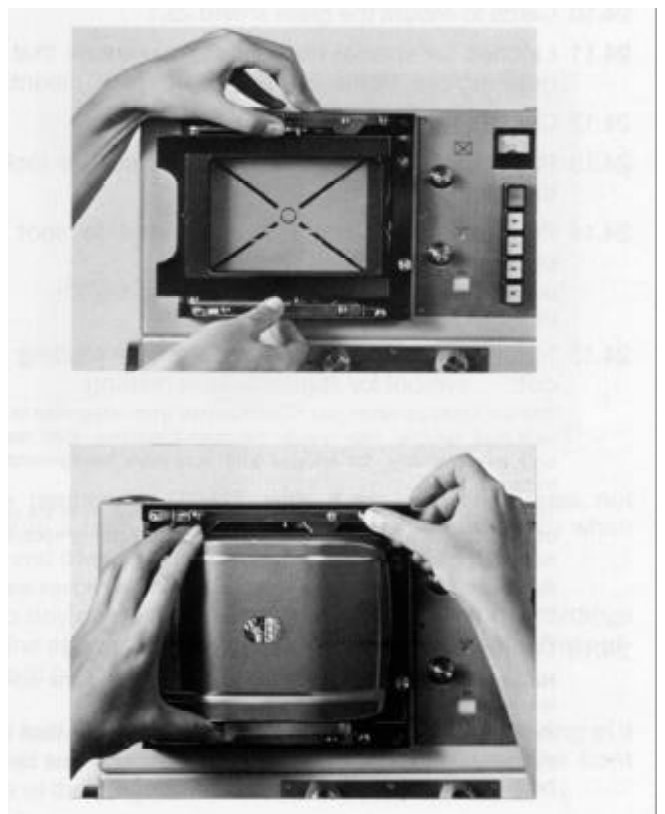
Make test exposures when using new photographic material, because the values the manufacturers indicate for the film speed are determined under conditions which are not exactly reproducible in practice.

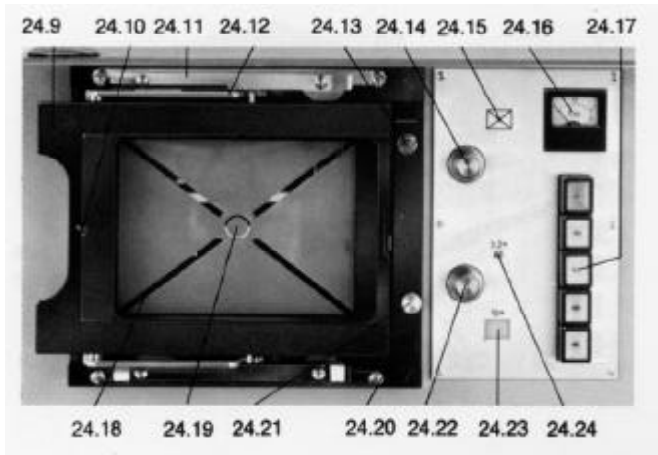
Turn setting knob 23.7 within ± 4 intervals of the film speed indicated for the material. Make one test exposure every interval (page 46) and set the speed producing the best result for your work. With the two reducing frames you will get eight 27×41.5 mm exposures on a single sheet film in the 4×5 " camera.

Remove the frame 24.9 and fit one reducing frame in front of the camera opening (the numbers 1–8 must be in the upper left corner), and release the exposure lock with knob 24.13 after each exposure.

Mounting of special magazines

1. Pull off glare shield 23.1.
2. Press in the two levers 24.12 and remove the frame by sliding it out. Proceed in the reverse order to mount the frame.
3. Fit the special magazine, e.g. a roll film magazine and fix with the latches 24.11.





24.9 Groundglass frame on camera back (international size)

24.10 Catch to mount the glare shield 23.1

24.11 Latches for special magazines: make sure that the groundglass frame is removed before mounting.

24.12 Clamp lever for groundglass frame

24.13 Red knob to release the double exposure lock of the 4×5" camera

24.14 Pushrod to change from integrated to spot exposure reading and vice versa

pushed in to the stop: integrated exposure reading
pulled out to the stop: spot exposure reading

24.15 frame: symbol for integrated exposure reading
dot: symbol for spot exposure reading

The dot lights up when you have changed from integrated to spot exposure reading. Use mainly integrated reading, spot reading only exceptionally, for images with very dark background, for instance.

The exposure time is determined by the light intensity in the center of the image. For exact localization of the measuring spot, use a focusing reticle with index ring in the insert with turret.

Remove this insert from the beam path when you do not want to image the circle.

24.16 Pointer instrument for exposure time range

No pointer deflection: long exposure times, the pointer advance is an indication of the exposure duration.

Pointer within the scale: short exposure times of less than 1 sec.

Pointer deflection exceeding the end of scale: shutter blocked because of excessive light.

24.17 Pushbuttons for shutter functions:

A automatic exposure control

B manual time exposure: the shutter remains open as long as the pushbutton is pressed

T manual time exposure: the shutter remains open as long as the pushbutton is engaged; the shutter is closed when the pushbutton is disengaged.

ready for flash exposure: synchronous contact for flash exposures; the 35 mm camera is operative when the pushbutton is engaged and lights up

"I" "ready" signal: it lights up when the camera is ready, it flashes when it is not, e.g. when in the 35 mm camera the end of the roll is reached or the film is torn in the magazine 472026 with frame counter. The camera functions are locked. Remove the magazine and press the pushbutton; this releases the locked functions.

When the pushbutton is pressed and no disturbance is indicated by flashing, the film is advanced by one frame without exposure (blank shot).

24.18 Clear diagonal stripes on the groundglass for adjustment with magnifier

24.19 Index ring for effective area for spot exposure reading

24.20 Window for 4×5" frame counter

24.21 Reset button for 4×5" frame counter

24.22 Pushrod to change from 4×5" to 35 mm exposures

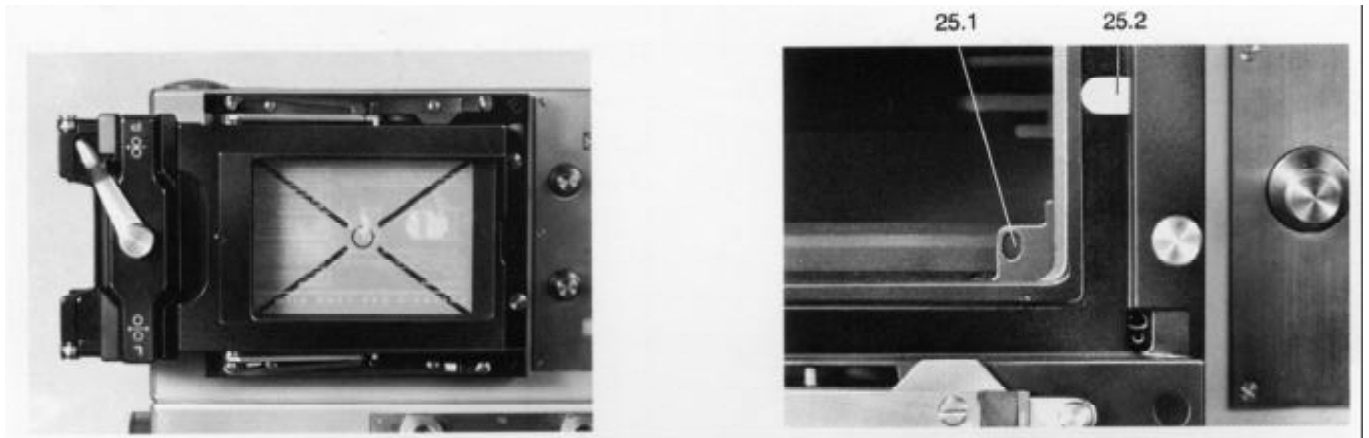
Inserted to the stop: 4×5" camera is operative, large field 24.23 lights up green

Inserted to center click stop: 35 mm camera is operative, small field 24.24 lights up green

Pulled out to the stop: free passage of image-forming beams upwards to 23.3 into TV or Videomat camera, for instance.

24.23 Luminous field for 4×5" camera
lights up green when the camera is operative

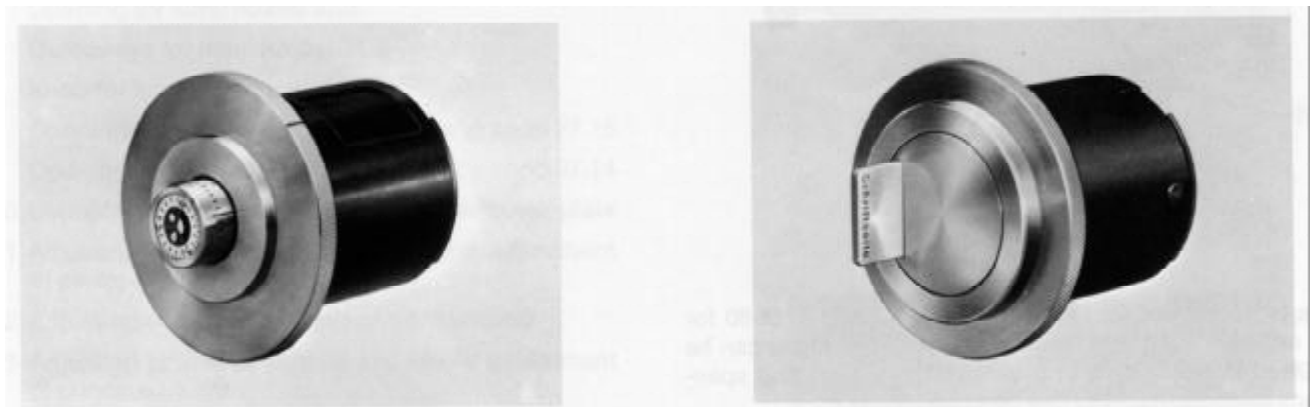
24.24 Luminous field for 35 mm camera
lights up green when the camera is operative



The Polaroid Land film holder is fixed with the latches 24.11 like a roll film magazine or slid behind the ground-glass screen.

If the lever 25.2 is pressed down by the insertion of a magazine, the next number follows in the window 24.20 and in the field 25.1.

Only when lever 25.2 is pressed down is power supplied to the photomultiplier for $4 \times 5''$ exposures.



The magazine 472026 with frame counter records each film advance and locks the automatic control if no film is loaded, the film is torn or the end of the film is reached.

Film cassette (47 20 27) for data recording,

If the cassette is exposed to bright light for some time with the slide removed, a trace of light may fall on the film through the slide slot.

If the cassette is loaded, the slide with or without foil should therefore always be inserted in the slot.

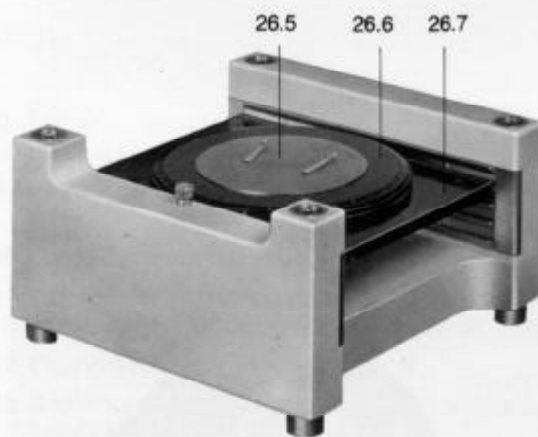
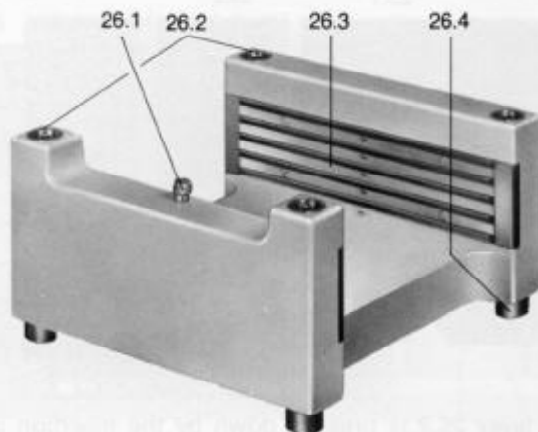
The magazine 472027 with data recording does not feature a frame counter. It blocks the film advance when the end of the film is reached.

Two tiny dots limit the 4 mm wide margin for recordings on the attached Astralon foils coated on one side. Recordings in pencil can be deleted any time.

The foil with the recording is put under the leaf spring of a slider and inserted to the stop into the slot on the front side of the magazine.

For reflected light only

Stage module R 475635



This is the carrier for the stages 475655 and 475660 for the reflected light upright microscope. The stages can be inserted from the side at 5 different levels, so that specimens up to 90 mm high can be examined.

26.1 Clamping screw

26.2 Fitting bores

26.3 Guideways for insertion of the stage at 5 different levels

26.4 Support

26.5 Insert AM for upright metallograph

26.6 Rotary polarizing stage 475660

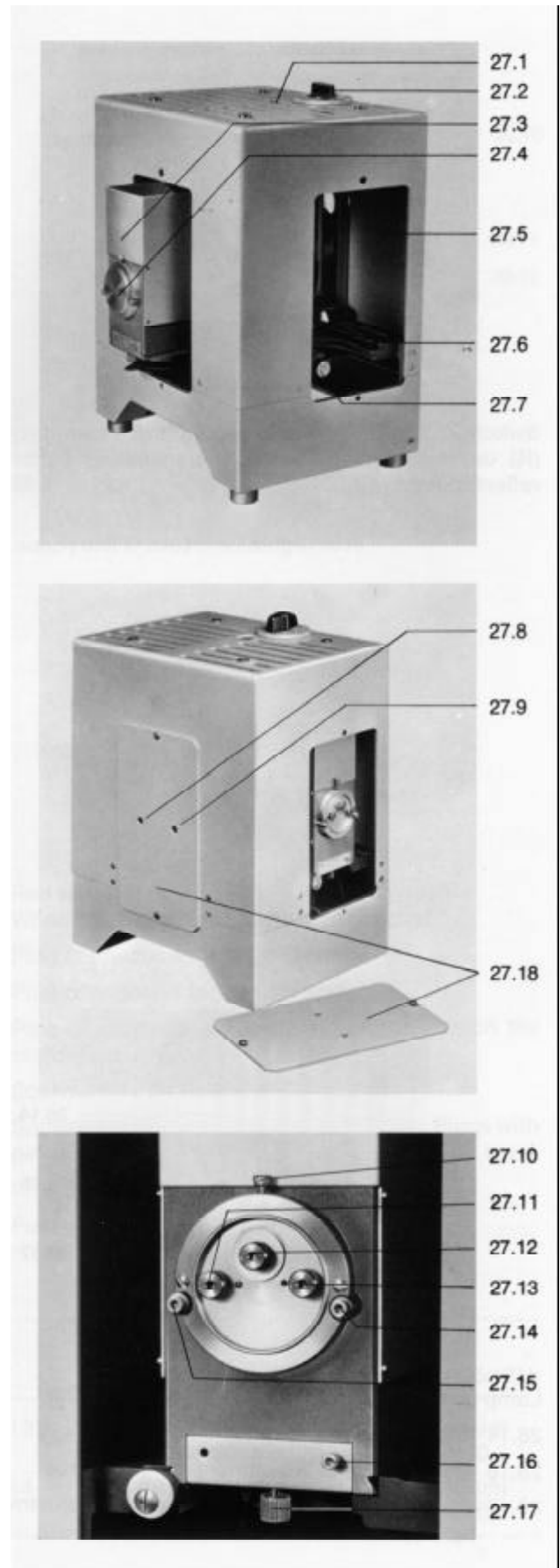
26.7 Supporting plate for stage

Lamp housing 475640

for max. 3 light sources

- 27.1 Screen to check the light source position during adjustment
- 27.2 Switch for changing the light sources
- 27.3 Lamp holder 475641
- 27.4 Cover plate for opening for concave mirror
- 27.5 Opening for lamp holder 27.3
- 27.6 Guideways for lamp holder 27.3
- 27.7 Knob for locking the lamp holder
- 27.8 Opening in cover plate giving access to knob 27.15
- 27.9 Opening in cover plate giving access to knob 27.14
- 27.10 Clamping screw for concave mirror or cover plate
- 27.11 Adjusting screws for vertical or lateral adjustment of concave mirror
- 27.12 Adjusting screw for concave mirror focusing
- 27.13 Adjusting screw for vertical and lateral adjustment of concave mirror
- 27.14 Knob for adjusting the diffusion disk
- 27.15 Knob for focusing the light source collector
- 27.16 Knob for lateral adjustment of light source
- 27.17 Screw for vertical adjustment of light source
- 27.18 Cover plate for openings for lamp holders 27.3

All light sources have our normal sockets which fit both into the lamp unit 250 and in the lamp holder 475641 of lamp housing 475640. See operating instructions G 41-320.





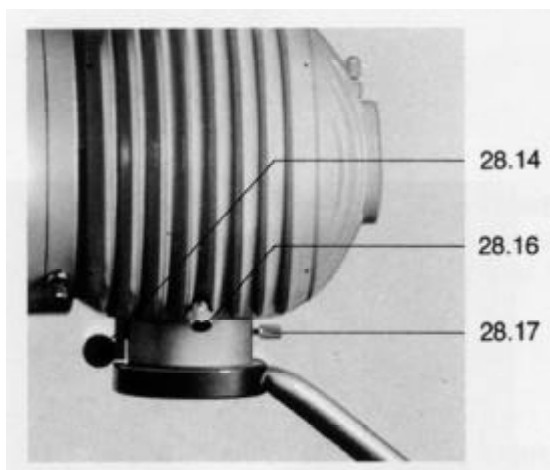
Switch 27.2 to change between light source left (L), right (R) or in the middle (M) for transmitted light (D) or reflected light (A).

Adjusting the light source in the lamp housing 475640

1. Unscrew cover plate 27.18
2. Switch on light source
3. Set switch 27.2 so that an image of the light source is formed on screen 27.1
4. Turn knob 27.14 to swing out diffusion disk
5. Focus the light source on the screen with knob 27.15
6. Fit the light source image into the index circle on the screen with knob 27.16 and screw 27.17

The following applies to the use of the concave mirror

- Form a light source image in one half of the index circle
 - Insert concave mirror and clamp with clamping screw 27.10
 - With the adjusting screws 27.12 adjust the mirrored image of the light source to the sharpness of the image directly produced on the screen
 - With the adjusting screws 27.11 and 27.13 adjust the mirrored image in the other half of the circle symmetrically to the directly produced image.
7. Swing in the diffusion disk 27.4
 8. Screw on cover plate 27.18.



Lamp unit 250 (operating instructions G 41–320)

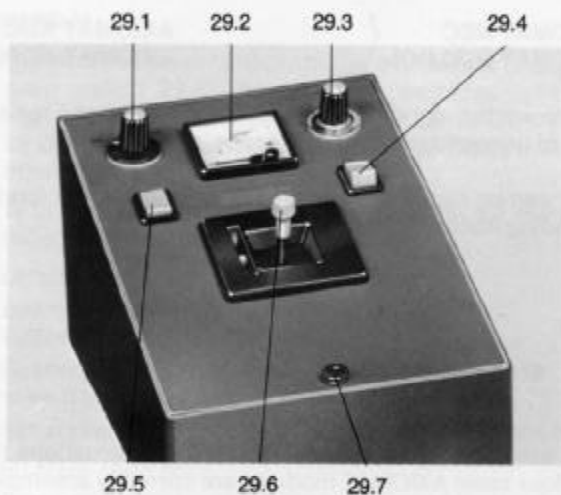
28.14 Knob for adjusting diffusion disk

28.16 Knob for lateral adjustment of light source

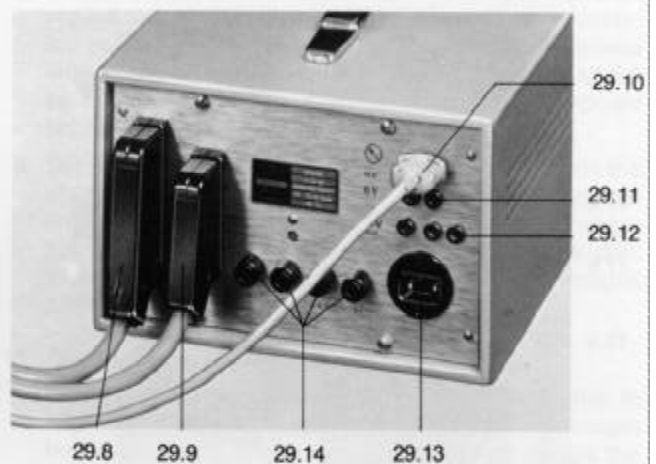
28.17 Clamp for lamp socket for vertical adjustment of light source

With the lamp unit 250 the light source must be adjusted on the microscope. With a light source in the lamp housing, the adjustment can also be carried out on the microscope. The light source adjustment can be checked in the lamp housing, and the adjustment can be made without having to operate the instrument. However, before starting to work, always check the light source adjustment (Sect. 11, pp.31 and 39).

Power supply and control unit



Control unit 47 56 90



Power supply unit 47 20 83 in housing 47 90 70

- 29.1 Knob "Int-Ext"
It transmits the function of the focusing lever 29.6 to a foot switch which is connected via socket 7.11.
- 29.2 Voltmeter
It displays the voltage of the 12V filament lamp connected via sockets 29.11 or 29.12 of the power supply unit.
- 29.3 Knob to operate the main switch and to regulate the voltage of the filament lamps.
- 29.4 ON-OFF switch for the auxiliary illumination 13.11 on the objective module.
- 29.5 Pushbutton "automatic"
It operates parallel to the pushbutton A on panel 24.17 of the camera module 47 56 20.
- 29.6 Lever for electronic focusing. Do not shift the lever next to this one.

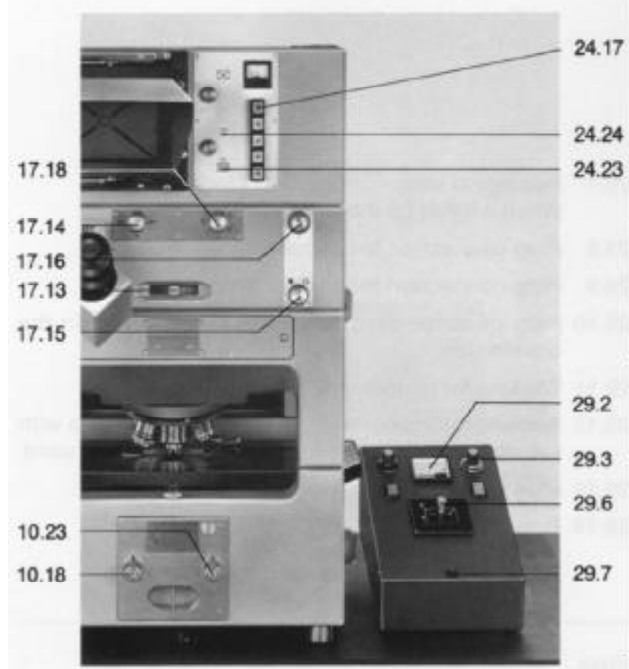
Note: **Objectives** are moved **away from the specimen** when the control lever is moved **away** from the user and **vice versa**. The movement is the faster the more the lever is shifted from zero position, allowing coarse and fine movements in both directions.

- 29.7 Red signal lamp
When it lights up the supply is connected.
- 29.8 Plug connection for camera cable
- 29.9 Plug connection for control unit
- 29.10 Plug of connecting cable to the voltmeter on the control unit
- 29.11 Sockets for connection of 6V loads
- 29.12 Sockets for the connection of 12V loads. Plugs with pin distances of 13 mm and 16 mm can be used.
- 29.13 Plug connection for the mains cable
- 29.14 Fuses

Fuse	Mains voltage	
	220 V / 240 V	100/110/125/127 V
Si 1, Si 2	1.6A medium delay 5 × 20	1.6A medium delay 5 × 20
Si 3, Si 4	4 A medium delay 5 × 20	6.3A medium delay 5 × 20

Working instructions

Ordinary transmitted light microscope (ND)



In some illustrations single parts are identified by numbers. Each number indicates the page on which you will find the illustration, and the numbers identifying the part.

AXIOMAT NDC AXIOMAT NDC POL

AXIOMAT NDC FI AXIOMAT NDPC

These are the upright microscope configurations for any type of transmitted light microscopy in visible light.

They can be supplemented for reflected light work (corresponding instructions see page 38).

It is assumed for the following working instructions that the four basic AXIOMAT modules are correctly assembled, and that all accessories are checked for completeness and are mounted at the correct places.

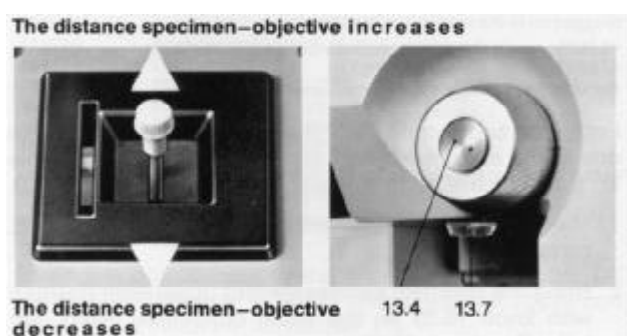
Accessories for NDC basic setup

47 56 30	Stage module T
47 57 31	Zoom condenser insert
46 52 91	Condenser 1.4
47 57 21	Mirror insert for zoom condenser
47 57 01	Lamp field stop slider for zoom condenser
47 57 05	Aperture diaphragm slider
47 58 00	Filter slider
47 56 55	Mechanical stage 60 × 120
47 59 59	Short coaxial drive
47 59 40	Stage insert D
47 59 01	Specimen clip left
47 59 00	Specimen clip right
47 56 01	Objective module
47 56 09	Sixtuple revolving nosepiece
47 56 90	Control unit
47 56 10	Observation module with zoom OPTOVAR 0.8 ... 3.2 ×
47 56 19	Binocular tube
46 40 30	Wide-angle, high-eyepoint eyepiece 10 × / 25
47 57 70	Reticle insert
	Focusing reticle, page 22
47 56 20	4 × 5" / 35 mm camera with glare shield and 2 cables
47 20 26	Magazine with frame counter
47 61 22	Double magazine for 4 × 5" format
47 56 48	Large cable box
	Lamp unit with power supply
47 20 83	Power supply unit
47 90 71	Housing
38 00 71-2810	Mains cable with safety plug

46 22 03	Planachromat 5 × / 0.12
46 22 04	Planachromat 10 × / 0.25
46 22 55	Planapochromat 25 × / 0.65
46 22 56	Planapochromat 50 × / 0.95
46 22 58	Planapochromat 100 × / 1.3 oil
47 59 90	Tool kit AXIOMAT

Brightfield

1. Connect the power supply to the mains, and switch on main switch 29.3. The following elements light up: signal lamp 29.7, pushbutton "I" on panel 24.17, field 24.23 or 24.24, and the filament lamp. Switch on any other light source separately.
2. With knob 29.3 adjust 12V rated voltage for the light source and check on the voltmeter 29.2.
3. Direct the total light flux into the tube:
 Beam splitter I (17.13): ←
 Beam splitter II (17.6): →
 Beam splitter III (17.14): set the index mark to ●, and to ← if tube 2 is used.
 Set zoom OPTOVAR 17.18 to "1", and the index mark on knob 17.15 to ○.
4. Place the specimen on the stage, and swing in the Planachromat 10×/0.25.
5. Bring the condenser head into uppermost position by turning knob 10.23 clockwise.
 Set number "10" on knob 10.18 below the dot index. Focus the eyepieces on the reticle. Set zoom OPTOVAR to "2.5".
 Turn the eyepiece tubes clockwise until the crosslines – with the focusing reticle the double lines at the format edges – appear sharp.
6. Look into the eyepiece, find the specimen image with lever 29.6 on control unit, and focus.
 If at the beginning you do not achieve sharp focus with this lever, refocus with the precise focusing 13.4. If the image is too bright, reduce the lamp voltage with knob 29.3 or use a suitable filter.



7. Close the lamp field stop 9.6 by turning the disk counterclockwise until its edge becomes visible in the field of view, though unsharp and not centered. Focus on the edge of the lamp field stop with knob 10.23. The lamp field stop image will then lie exactly in the specimen plane.

8. Center the lamp field stop image in the eyepiece with regard to the edge of the field of view with the centering screws on slider 9.6. Correct the image sharpness with 10.23, if necessary. Open the lamp field stop 9.6 by turning clockwise, until its edge just disappears behind the edge of the field of view.
9. Set index mark on knob 17.15 to ●. The image of the objective aperture becomes visible in the eyepiece, and in this image an image of the aperture diaphragm 9.4 and the lamp coil, provided the diffusion disk 27.14 or 28.14 of the lamp is swung out. Both images are neither sharp nor centered.
10. Centering the aperture diaphragm:
 Close the aperture diaphragm by turning the disk in slider 9.4 clockwise, until the edge of the diaphragm becomes visible in the objective aperture. Focus the auxiliary objective on the diaphragm edge with knob 17.16.
 Center the diaphragm edge with regard to the objective aperture with the centering screws in slider 9.4. Adjust the aperture diaphragm 9.4 so that the diameter of its image corresponds to about $\frac{2}{3}$ to $\frac{3}{4}$ of the diameter of the full objective aperture.
11. Adjusting the light source
 Use tube 2 for the purpose.
 ● Swing out the diffusion disk (27.14 and 28.14) on the light source.
 ● Shift the lamp socket so that the image of the lamp coil lies in the center of the objective aperture.

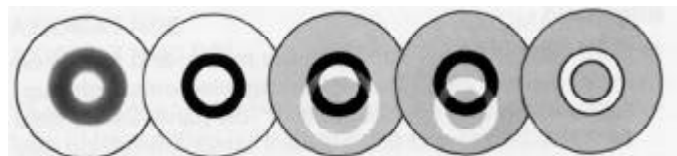


- With the centering screw on the lamp holder bring the coil image at right angles to the above also to the center of the objective aperture.
 - Swing in the diffusion disk. Never omit with inhomogeneous light sources!
12. Set index mark on knob 17.15 to ○.
 The evenly illuminated specimen image is now visible and you may start working.

The magnification is changed by exchanging the objective or with the zoom OPTOVAR. That is all you have to do when the instrument has been adjusted in the manner described above.

When changing the objective, set the magnification of the objective in use below the index dot on knob 10.18. This dot has the same color as the index ring on the objective. In this position, the size of lamp field stop and aperture diaphragm are automatically adapted to the new objective. Depending on the specimen the opening of the aperture diaphragm 9.4 must be varied in order to determine the optimum image contrast.

When setting the zoom OPTOVAR the diaphragms need not be changed. However, for exact Koehler illumination the diameter of the lamp field stop image must always be adapted to the diameter of the field of view.



into the beam path, and its image is also visible in the eyepiece. Bring it to coincidence with the phase ring in the objective regarding size and position:

- Set knob 10.18 so that the size of the annular diaphragm image corresponds to that of the phase ring in the objective.
- Bring the annular diaphragm image to coincidence with the phase ring with the screws in the slider 9.4.
- Set the index mark on knob 17.15 again to $\bigcirc$.
You can now observe the phase contrast image of the specimen.

Phase contrast

Accessories

465293 Condenser head 0.9

Objectives with built-in phase ring:

462265	Planapochromat 25× / 0.65 Ph
462266	Planapochromat 50× / 0.95 Ph
462267	Planapochromat 50× / 1.00 Ph oil
462268	Planapochromat 100× / 1.30 Ph oil
462345	LD-Planapochromat 16× / 0.30 Ph (working distance = 19 mm)

The zoom condenser insert (page 10) must be equipped with the condenser 0.9 (10.13).

This condenser can be used for brightfield work if oil immersion is not necessary which is, however, hardly ever required.

- Having completed the adjustments according to 1. through 8. on page 30, focus the lowest power phase contrast objective on the specimen.
- Set the index mark on knob 17.15 to $\bullet$.
An image of the objective aperture with the phase ring (generally unsharp) becomes visible in the eyepiece.
- Focus the phase ring with knob 17.16.
- Pull out the aperture diaphragm slider 9.4 by one click stop; this brings the phase contrast annular diaphragm

Darkfield

Accessories

465500 Ultra condenser 1.2 ... 1.4 (10.12)

475740 Carrier ring (10.24)

For objective apertures between 0.65 and 1.0. The aperture of the 100× / 1.30 objective must be reduced to at least 1.0 by a diaphragm which is plugged on to the rear part of the objective.

465505 Dry darkfield condenser 0.78–0.95 (10.11)

475740 Carrier ring (10.24)

For objective apertures between 0.6 and 0.75

Equip the zoom condenser insert 475731 (page 10) with one of the aforementioned darkfield condensers suitable for the objective used. See also explanations on page 10.

- Make the basic adjustment according to 1. through 3. on page 31.
- Bring the darkfield condenser into uppermost position with knob 10.23 on the zoom condenser insert. Set letter D on knob 10.18 below the index dot.
- Place the specimen on the stage.
The front surface of the ultra condenser 10.12 must be connected with the bottom surface of the specimen slide by immersion oil, since otherwise darkfield illumination is not achieved.
- Use the objective 25× / 0.65 for further adjustments. View the specimen image through the eyepiece and focus.

5. Open the aperture diaphragm 9.4 completely. Close the lamp field stop 9.6 about half way.
6. Adjust the condenser by small amounts with 10.23 until a lamp field stop image is produced in the specimen.
7. Swing in the objective for observation. Center the lamp field stop with screws on slider 9.6 and open it until the entire field of view is illuminated.

Differential interference contrast (DIC)

Accessories

47 58 57	DIC revolving nosepiece with built-in DIC prisms for the objectives 10×/0.25; 25×/0.65; 50×/0.95; 100×/1.30
47 58 50	Condenser slider with 2 DIC prisms
47 58 10	Transmitted light polarizer 9.9
47 58 20	Analyzer slider 14.11
47 58 34	Slide for auxiliary optics with
47 58 35	λ-plate first order red for color contrast
47 57 60	Analyzer sliding tube 15.21
46 52 94	Condenser 1.4 Pol
46 22 04	Planachromat 10×/0.25
46 22 55	Planapochromat 25×/0.65
46 22 56	Planapochromat 50×/0.95
46 22 58	Planapochromat 100×/1.3 oil

Optimum DIC effect is achieved with structures which are diagonal in the field of view, for which purpose we recommend:

47 56 60	Rotary polarizing stage, page 12
47 59 41	Insert A

Insert the objectives into the proper sockets of the DIC revolving nosepiece 47 58 57, and equip the zoom condenser insert with the condenser 1.4.

Replace cover plate 10.20 by condenser slider 33.1 with 2 DIC prisms 47 58 50, and cover plate 10.21 by transmitted light polarizer 9.9. Insert the analyzer slider 14.11 into the sliding tube 15.21 according to the instructions on page 16. Remove cover plate 13.2, insert the analyzer sliding tube into opening 14.6, and fix with the corresponding screws.

The obtainable image contrast is determined by the exact cross position of analyzer and polarizer.

Crossing analyzer and polarizer

Remove eyepieces from the tube. Swing out DIC condenser prisms. Remove revolving nosepiece.

Swing in polarizer 9.9 and analyzer 14.11. Set polarizer into click stop position 0.

Rotate analyzer 14.11 in both directions and clamp when maximum darkness is achieved in the objective aperture. The graduation on the analyzer should display 90°.

If this is not so, turn the graduated ring into the correct position after loosening the three screws holding it with a small screwdriver.

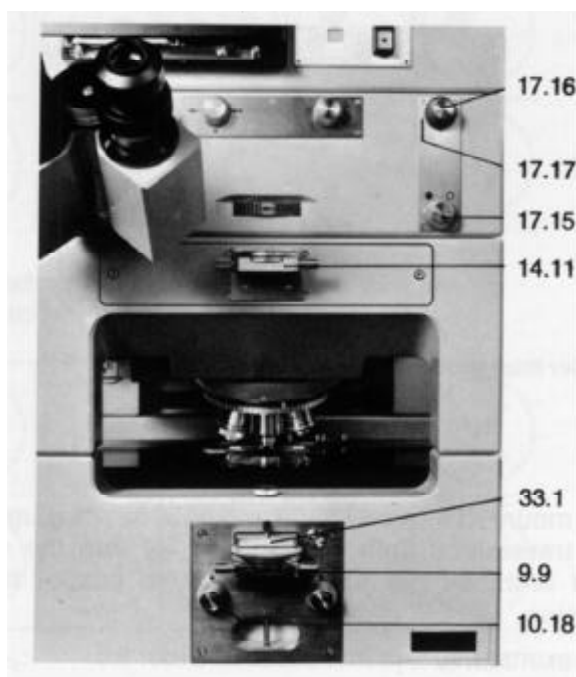
1. Insert revolving nosepiece. Pull out polarizer 9.9 and analyzer 14.11 and slider with DIC prisms. With 10× objective adjust to brightfield according to Sect. 1. through 10. on page 31.

A normal brightfield image will even appear when either analyzer or polarizer is swung out of the beam path.

2. Swing in polarizer, analyzer and the DIC condenser prism corresponding to the objective in use.
3. Set the lever on the objective screw thread so that the structures to be enhanced by DIC are especially pronounced.

When operating this lever, the DIC imaging prism is shifted diagonally to the vibration direction of polarizer and analyzer, which changes the contrast intensity between black and white. Insertion of the auxiliary object λ (first order red) or turning the polarizer into 90° position (parallel position to the analyzer) produces color contrast.

Amplitude contrast: the DIC of weakly colored specimens can be increased by alternatively rotating the polarizer and the lever on the objective. Turn the polarizer by small amounts in each direction until maximum contrast is achieved.



Fluorescence

Accessories

Barrier filter for filter slider 47 58 00

for brightfield excitation:

46 78 81 Exciter filter UG 5, 32×2

46 78 82 Exciter filter UG 1, 32×3

46 78 83 Exciter filter BG 3, 32×4

46 78 84 Exciter filter BG 12, 32×4

for darkfield excitation:

46 79 80 Exciter filter KP 500, 32 mm dia.

Heat protection filter:

for lamp holder 47 56 44:

46 78 85 Red attenuating filter BG 38, 32×2.5, in

47 58 00 Filter slider

46 79 30 Heat protection filter KG 01, 50 mm dia.

for lamp housing 47 56 40 (page 27):

47 59 60 Heat protection filter KG 01, 50 mm dia., in mount

47 59 62 Red attenuating filter BG 38, 50 mm dia., in mount

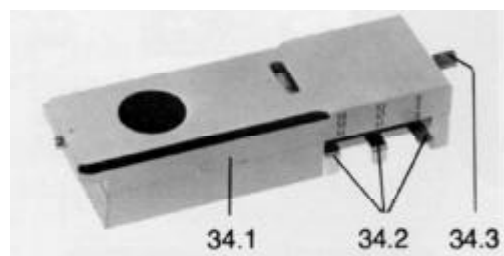
47 58 01 Barrier filter slider with filters

For fluorescence microscopy, equip the AXIOMAT NDC with the high-pressure mercury source HBO 200 and a suitable combination of exciter and barrier filters.

The light source fits into lamp unit 250, 47 25 10 or into lamp housing 47 56 40. In the lamp housing you may use besides the mercury source a second light source (e.g. a filament lamp). Both are switchable to either transmitted or reflected light. Always use the mercury source with the adjustable concave mirror 46 72 94 or 47 56 46 (27.11).

To protect the exciter filters from excessive heat, insert between light source and filter slider the heat protection filter 46 79 30 or 47 59 60 and the red attenuating filter BG 38, 46 78 85 or 47 59 62.

In lamp unit 250 the filter 46 79 30 is inserted into a recess on the lamp holder 47 56 44 and retained by two loose screws. In a second filter slider filter 46 78 85 can be slid into the lamp holder (Fig. page 8).



Barrier filter slider 47 58 01

The mounted filters 47 59 60 and 47 59 62 are plugged into the transmitted light exit opening or into the opposite light entrance opening in the cable box of the lamp housing.

The exciter filters fit into the filter slider 9.5.

Insert the **barrier filter slider** 34.1 to the stop after pulling out the cover slider 13.9 of the objective module 47 56 01 and turning back the stop screw 13.13. Lock it by pressing in and turning knurled screw 34.3 to avoid shifting when moving the three barrier filter carriers 34.2 back and forth.

Except for the selection of the suitable exciter/barrier filter combination, follow the instructions for brightfield on page 30. The aperture diaphragm can be kept completely open because it acts here only on the illumination intensity but not on the image contrast.

Polarized light

Accessories

47 56 08	Centered quadruple revolving nosepiece
47 58 10	Transmitted light polarizer 9.9
47 58 20	Analyzer slider 14.11
47 57 60	Analyzer sliding tube 15.21
46 52 94	Condenser 1.4 Pol
47 58 30	Slider with auxiliary objects 13.9
47 57 71	Slider with reticle turret 17.4
	with
	focusing reticle (page 22) and
47 59 96	2 mounts 32/19, and
47 58 90	2 reticles 19×2
47 57 80	Centered reticle
47 56 60	Rotary polarizing stage
	with
47 59 41	Insert A
46 22 24	Planachromat 10×/0.25 Pol
46 22 75	Planapochromat 25×/0.65 Pol
46 22 76	Planapochromat 50×/0.95 Pol
46 22 78	Planapochromat 100×/1.30 Pol oil

Leave the polarizer 10.21 swung in during polarizing microscopy. Swing in the analyzer to observe or measure interference figures.

Leave the reticle in the revolving turret with horizontal and vertical lines swung in, except for photography with the zoom OPTOVAR.

Centering the rotary polarizing stage

Do this once before starting operation. Leave the analyzer 14.11 swung out.

- 1. Following the adjustments 1. through 8. on page 30, focus a 10× objective rigidly mounted on the revolving nosepiece 475608 (page 16) on a fine-grain specimen.
- 2. Turn the specimen stage uniformly with one hand on either side. Shift the specimen until one point in the specimen lies in the axis of rotation of the stage, and mark this point.
- 3. Shift the stage plate with screwdriver M 4 in opening 12.12 until the axis of rotation of the stage lies in the center of the reticle.

Centering the objectives

- 1. The stage is centered, and the objectives screwed into the centerable openings of the revolving nosepiece 475608 (page 16).
- 2. Turn the stage uniformly. Bring the reticle to coincidence with the axis of rotation with socket wrenches on the two centering screws 16.2 at the objective openings.

Transmitted light polarizing microscope AXIOMAT NDC POL

Optical character in the conoscopic image

Insertion direction of auxiliary object and compensator
The reference directions are diagonal to the insertion direction

Auxiliary object or compensator	Reference direction γ of the auxiliary object	Optically uniaxial		Optically biaxial			
		Section at right angles to the optical axis		Section at right angles to the acute bisectrix		Diagonal position	
		+	−	+	−	+	−
λ plate first order red in 475830 (13.9)							
$\lambda/4$ plate (13.9)							
Motion direction of interference fringes of equal path difference when inserting the quartz wedge or tilting the compensator plates from zero position							
Quartz wedge 0–2 (13.9) Calcite tilting compensator 475845							
Quartz tilting compensator 475840							

The conditions in **tube 1** (17.9) are shown in the table from this direction

The conditions in **tube 2** (17.11) are shown in the table from this direction

Conoscopic observation

Use objectives of high numerical aperture for the observation of interference figures of birefringent media in polarized light in the objective pupil.

The numerical illuminating aperture of the condenser must be at least equal to that of the imaging objective, and the condenser must be immersed with immersion objectives.

Adjustment

Specimen stage and objectives are centered.

1. Bring the image of the specimen whose interference image is to be examined, into the center of the reticle.
2. Use an objective of high numerical aperture.
Adjust the pancratic system of the condenser to this objective with knob 10.18. Open the aperture diaphragm on slider 9.4.
3. Set index mark on knob 17.15 to ●, the Bertrand lens is swung in. Close the Bertrand diaphragm with ring 17.17 and focus with knob 17.16 until the interference image is clearly visible in the objective pupil.

Looking through the tube without eyepiece shows the specimen image encircled by the Bertrand diaphragm. Through a centering telescope 464822 it appears magnified; this telescope can be inserted instead of one eyepiece with reducing ring 464911 and focused by sliding in its eyelens.

When diaphragm 17.17 is closed too much, the brightness and sharpness of the interference image is impaired.

If despite open aperture diaphragm 9.4 the objective pupil is not fully illuminated, improve adjustment with knob 10.18.

4. In case of extraordinary behavior of the interference image during stage rotation, look through the tube without eyepiece and check with the Bertrand lens swung in whether the specimen image remains within the stopped down Bertrand diaphragm 17.17 during stage rotation. If not, centering of specimen stage or objective must be corrected.
5. Set the index mark on knob 17.15 to ○ for orthoscopic observation.

Measuring central distances in the conoscopic image

Like determining axial angles according to Mallard's method

1. Place insert 475782 with crossline micrometer into opening 17.4.
2. Center crosslines with regard to the pupil image.
3. Measure the distance between the striking point in the interference image (e.g. the vertex point of an isogyre) and the crosslines in scale divisions.

When determining the optical character in the conoscopic interference image, the quadrants in the tube 2 are rotated through 90° with regard to those in tube 1.

Working instructions

Ordinary Reflected Light Microscope AXIOMAT NAC

Inverted Reflected Light Microscope AXIOMAT IAC

Reflected light

Brightfield**Accessories**

47 56 01	Objective module
47 56 09	Sixtuple revolving nosepiece
47 56 90	Control unit
47 57 05	Aperture diaphragm slider
47 58 00	Filter slider
47 57 55	Reflector HPI-Pol + D
47 57 10	Lamp field stop slider for reflected light
47 57 60	Analyzer sliding tube
47 57 59	Reflected light mirror
47 56 55	Mechanical stage 60 × 120
47 56 10	Observation module with zoom OPTOVAR 0.8 ... 3.2 ×
47 56 19	Binocular tube
46 40 30	Wide-angle, high-eyepoint eyepiece 10 × / 25
47 57 70	Reticle insert
	Focusing reticle page 22
47 56 20	4 × 5"/35 mm camera with glare shield and 2 cables
47 20 26	Magazine with frame counter
47 61 22	Double magazine for 4 × 5"
47 56 29	Observation mirror for inverted microscope
	Lamp unit with power supply unit
46 22 23	EPIPLAN HD 5 × / 0.12
46 22 34	EPIPLAN HD 10 × / 0.25
46 22 85	EPIPLANAPOCHROMAT HD 25 × / 0.65
46 22 86	EPIPLANAPOCHROMAT HD 50 × / 0.95
46 22 88	EPIPLANAPOCHROMAT HD 100 × / 1.3 oil
47 59 90	Tool kit AXIOMAT

Accessories for AXIOMAT NAC alone:

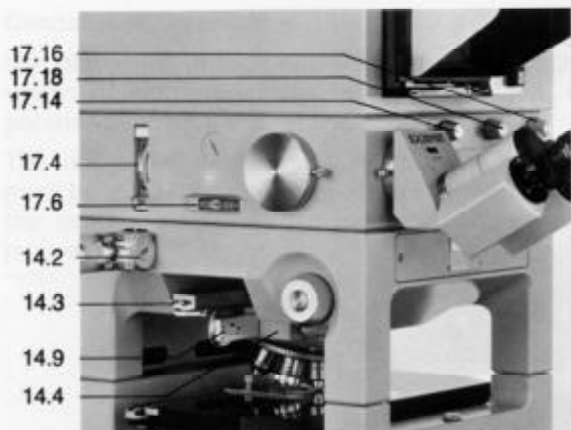
47 56 35	Stage module R
47 56 59	Short coaxial drive
47 59 05	Specimen plate A
47 56 48	Large cable box
47 56 44	Lamp holder

Accessories for AXIOMAT IAC alone:

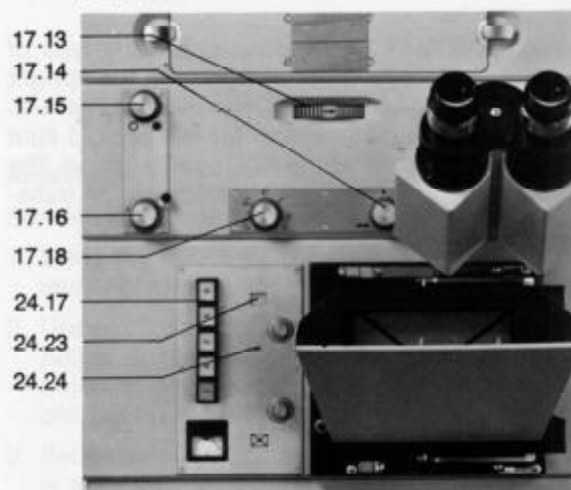
47 56 39	Base I
47 56 36	Stage carrier for inverted microscope
47 56 58	Long coaxial drive
47 59 09	Specimen plate UM
47 59 43	Stage insert 24
47 59 44	Stage insert 48

These are the AXIOMAT configurations for any type of reflected light microscopy in visible light with the upright (NAC Pol) or inverted (IAC, IAC Pol) microscope. The NAC configuration can be supplemented for transmitted light work only by converting it into the NDC configuration. The IAC configurations are easier to supplement for transmitted light work (page 38).

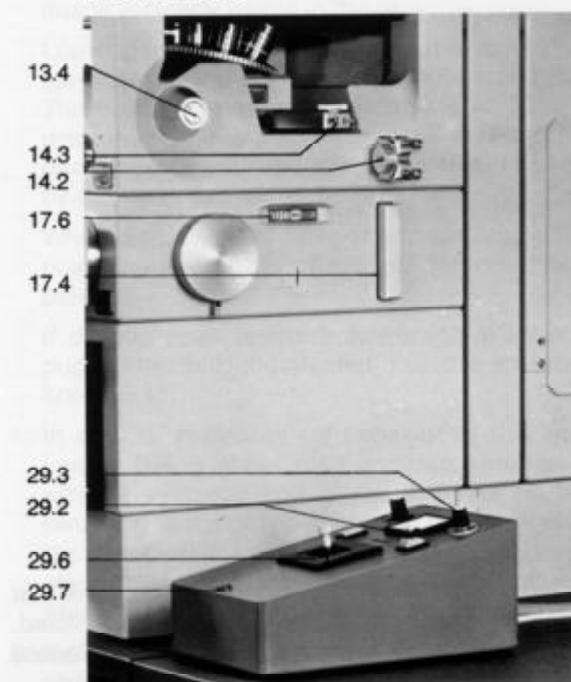
It is assumed for the following working instructions that the four basic AXIOMAT modules are correctly assembled, and that all accessories are checked for completeness and are mounted at the correct places.



AXIOMAT NAC



AXIOMAT IAC



Reflected light

Brightfield

1. Connect the power supply unit to the mains. Switch on the main switch 29.3. The following elements light up: signal lamp 29.7, pushbutton "I" on panel 24.17, field 24.23 or 24.24, and the filament lamp. Switch on any other light source separately.
2. With knob 29.3 adjust 12V rated voltage for the microscope illuminator, and check on voltmeter 29.2.
3. Direct the entire light flux into the tube:

	AXIOMAT NAC	IAC
Beam splitter I (17.13):	←	→
Beam splitter II (17.6):	→	←
Beam splitter III (17.14):	●	●
Tube 2:	←	→

Set zoom OPTOVAR 17.18 to "1", and index mark on knob 17.15 to ○.

4. Place the specimen on the stage and swing in the objective EPIPLAN HD 10×/0.25.

Make sure that the specimen surface under test (e.g. the surface of a section) is **adjusted exactly at right angles to the optical axis**. Even slight deviations in the adjustment cause a decrease in sharpness in the image which, with high-power objectives, may also be due to a section surface which is not completely plane.

With a 100× immersion objective the depth of field is in the order of magnitude of only $\frac{1}{10}$ micron! Either embed the polished section in casting resin with the contrast surface exactly parallel to the polished surface, or press it on a specimen slide with plastiline and a well adjusted alignment press. Do not exert too much pressure because of the elastic deformation capability of the plastiline.

5. Check whether reflector 475755 (14.4) is inserted to the stop and whether the illuminator is switched to reflected light.

Focus the eyepieces on reticle 17.4.

Turn eyepiece tubes clockwise until the crosslines – with the focusing reticle the double lines at the format edges – appear sharp.

6. Look into the eyepiece, find the specimen image with focusing lever 29.6 on control unit and focus.

If at the beginning you do not achieve sharp focus with this lever, refocus with the precise focusing 13.4. If the image is too bright, reduce the lamp voltage or use a suitable filter.

7. Close the lamp field stop by turning the knurled disk 14.3 counterclockwise until its edge becomes visible in the field of view.

8. Center the lamp field stop image in the eyepiece with regard to the edge of the field of view with the centering screws. Open the lamp field stop until its edge just disappears behind the field of view edge.

The following adjustments can only be made when the specimen has the properties of a mirror (polished section):

9. Set index mark on knob 17.15 to : the auxiliary objective is swung in. The image of the objective aperture becomes visible in the eyepiece, and in this image an image of the aperture diaphragm and the lamp coil (provided the diffusion disk in the light source is swung out). Both images are neither sharp nor centered.
10. Centering the aperture diaphragm:
Close the aperture diaphragm by turning the knurled knob 14.2 clockwise, until the edge of the diaphragm becomes visible in the objective aperture. Focus on the edge of the diaphragm with knob 17.16. Center the edge of the diaphragm with regard to the objective aperture with the centering screws 14.2. Adjust the aperture diaphragm so that the diameter of its image corresponds to about $\frac{2}{3}$ to $\frac{3}{4}$ of the diameter of the full objective aperture.



11. Adjusting the light source

Use tube 2 for the purpose.

- Swing out the diffusion disk (e.g. 27.14) on the light source.
- Shift the lamp socket so that the image of the lamp coil lies in the center of the objective aperture.
- With the centering screw on the lamp holder (e.g. 27.16) bring the coil image at right angles to the above also to the center of the objective aperture.
- Swing in the diffusion disk. Never omit with inhomogeneous light sources!

12. Set index mark on knob 17.15 to .

The evenly illuminated specimen image is now visible, and you may start working.

Once the instrument has been adjusted in the manner described above, all you have to do is changing the magnification by

exchanging the objective or
adjusting the zoom system 17.18

When changing the objective, the lamp field stop 14.3 need not be adjusted, because with reflected light bright-field illumination each objective acts as its own condenser.

Adjust the aperture diaphragm 14.2 only when deemed necessary to improve the image contrast.

When adjusting the zoom system for reflected light brightfield work, always adapt the size of the lamp field stop 14.3 to the eyepiece field of view **to avoid straylight**.

Reflected light

Darkfield

Accessories: no special accessories required. The objectives and the reflector HPI-Pol + D (13.9) are provided accordingly.

1. Adjust brightfield illumination according to Sect. 1. through 6. on page 38.
2. Open the aperture diaphragm 14.2 completely, and pull out the lamp field stop slider 14.3 to the last click stop and the reflector HPI-Pol + D (14.4) to the last stop.

The darkfield is obtained.

In case of insufficient brightness, remove all light attenuating elements from the beam path, run the filament lamp (not halogen lamps) at overload, or use a light source of higher luminance.

Because of the extraordinarily large field of view the objective receives less straylight from the edges than from the center, which results in a decrease in brightness. This decrease is unavoidable and must be accepted.

Reflected light

Polarizing microscopy

Differential interference contrast (DIC)

Accessories

47 58 55	Revolving nosepiece with built-in DIC prisms for the objectives 10×/0.30; 25×/0.65; 50×/0.95; 100×/1.30
47 58 15	Reflected light polarizer 14.9
47 58 20	Analyzer slider 14.11
46 22 43	EPIPLAN HD 5×/0.12 Pol
46 22 44	EPIPLAN HD 10×/0.25 Pol
46 22 95	EPIPLANAPOCHROMAT HD 25×/0.65 Pol
46 22 96	EPIPLANAPOCHROMAT HD 50×/0.95 Pol
46 22 98	EPIPLANAPOCHROMAT HD 100×/1.3 Pol oil
47 56 60	Rotary polarizing stage (page 12)
47 59 43	Stage insert with 24 mm dia.
47 59 44	Stage insert with 48 mm dia.

For polarized light work alone, screw the objectives into the centered quadruple nosepiece, 47 56 08. Screw the objectives 10× into the non-centerable socket.

For differential interference contrast the objective **must** be screwed into the sockets of the special revolving nosepiece, 47 58 55, which are marked accordingly.

As described under 15.13, insert the reflected light polarizer, 47 58 15 (page 16) into the reflector HPI-Pol+D, 47 57 55 (15.12), and the analyzer slider 14.11 into the analyzer sliding tube 15.21.

Align reflected light polarizer and analyzer so that their vibration planes are exactly crossed, and run parallel or at right angles to the plane of incidence of the reflector. Faulty alignment impairs the obtainable optimum image contrast!

Aligning the polarizers

1. Place surface mirror or polished section with optically isotropic, homogeneous surfaces as "test surface" on the specimen stage. This surface must be well aligned at right angles to the optical axis.
2. Remove the revolving nosepiece with the objectives.
3. Set the index mark on knob 17.15 to ●. The auxiliary objective (Bertrand lens) is swung in. Instead of the microscope objective it serves as observation objective for the test surface.
4. With knob 17.16 produce a sharp image of the test surface in the eyepiece with lamp field stop (14.3) and aperture diaphragm (14.2) completely open.
5. Swing in polarizer 14.9 in position 0°, and analyzer 14.11 in position 90°.

Slowly turn polarizer and analyzer alternately and simultaneously by small angular amounts in both directions, and fix the position of maximum darkness in the field of view.

This setting is very sensitive, and the fixed positions may slightly deviate from the 0° and 90° positions. A reddish or bluish tint in the field of view indicates that although polarizer and analyzer are crossed, they are not aligned with regard to the plane of incidence of the reflector. A greyish tint is an indication that although the polarizer is in correct position with regard to the plane of incidence of the reflector, the analyzer is not correctly crossed. Darkness without any color hue indicates correct alignment and crossing. Note the positions thus fixed for further work in polarized light.

Adjustment

Differential interference contrast (DIC)

Once the polarizers are aligned:

1. Mount the DIC revolving nosepiece with fitted objectives.
2. Swing out polarizer 14.9 and analyzer 14.11, and with objective 10× or 25× adjust brightfield illumination according to Sect. 1 through 10. on page 38.
3. Swing in exactly aligned polarizer 14.9 and analyzer 14.11.

While observing the image through the eyepiece, shift the lever on the threaded ring of the objective until the characteristic feature in the specimen (grain boundary, phase boundary, surface roughness) displays the desired contrast.

Inverted Transmitted Light Microscope AXIOMAT IDC

This is the AXIOMAT configuration for ordinary transmitted light microscopy with the inverted microscope in visible light. Furthermore, it allows the application of microscopic methods, so far realizable only with the upright microscope, photometry, for instance.

It is assumed for the following working instructions that the four basic AXIOMAT modules are correctly assembled, and that all accessories are checked for completeness and are mounted at the correct places.

Brightfield

Accessories

47 56 39	Base I
47 56 01	Objective module
47 56 09	Sixtuple revolving nosepiece
47 56 90	Control unit
47 56 36	Stage carrier for inverted microscopes
47 56 55	Mechanical stage 60 × 120
47 56 58	Long coaxial drive
47 59 03	Specimen frame
47 56 10	Observation module with zoom OPTOVAR 0.8 ... 3.2×
47 56 19	Binocular tube
46 40 30	Wide-angle, high-eyepoint eyepiece 10 × / 25
47 57 70	Reticle insert
	Focusing reticle, page 22
47 56 20	4 × 5" / 35 mm camera with glare shield and 2 cables
47 20 26	Magazine with frame counter
47 61 22	Double magazine for 4 × 5"
47 56 29	Observation mirror for inverted microscopes
47 56 37	Carrier for transilluminator I
47 72 56	Lamp unit 60 with collector and iris diaphragm
46 72 52	Holding ring for filter
47 56 38	Extension tube with auxiliary lens
46 52 72	Achromatic aplanatic phase contrast condenser IV Z/7
47 20 83	Power supply unit
47 90 71	Housing
38 00 71–2810	Mains cable with safety plug
46 22 03	Planachromat 5 × / 0.12
46 22 04	Planachromat 10 × / 0.25
46 22 55	Planapochromat 25 × / 0.65
46 23 44	Planapochromat 16 × / 0.3 (working distance = 19 mm)
47 59 90	Tool kit AXIOMAT

We offer "specimen plates" to mount the various chambers, counting vessels, etc. on the specimen stage. If none of these is suitable, ask the manufacturer (Abteilung Mikro-Labor) for special ones.

Working without the condenser

The aperture of the light bundle emitted by the light source is generally smaller than that of the observation objective. Therefore, the contrast of the specimen image corresponds to that of a stopped-down condenser.

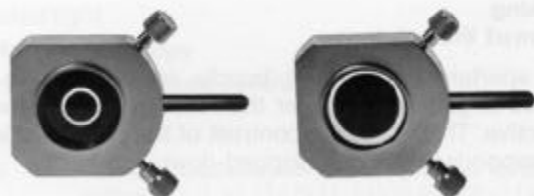
- Mount light source 467256 on carrier U, 475637 8–10 cm directly above the specimen.
- Open diaphragm 43.5. Set the slot in knob 43.4 into light direction which swings out the diffusion disk.
Sometimes this will work only when the lamp socket fixed with clamp 43.3 is not plugged in right to the stop.
- Loosen clamp 43.3. Place a sheet of paper on the specimen. Shift the lamp socket until a sharp image is produced of the coil. Tighten clamp 43.3 and swing in diffusion disk 43.4.

Brightfield

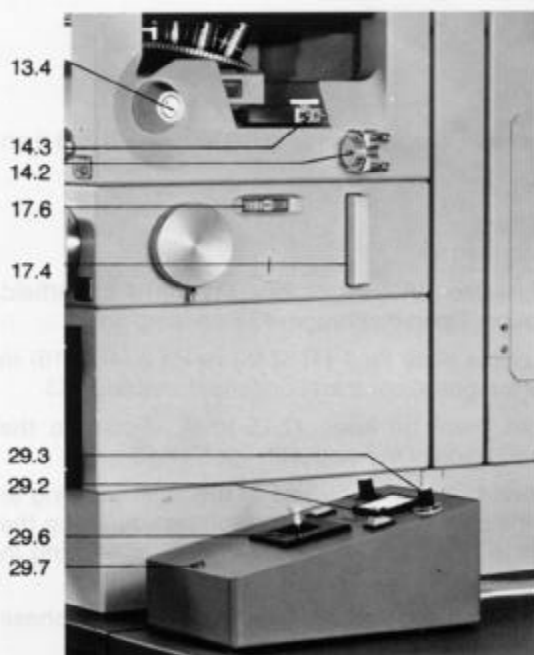
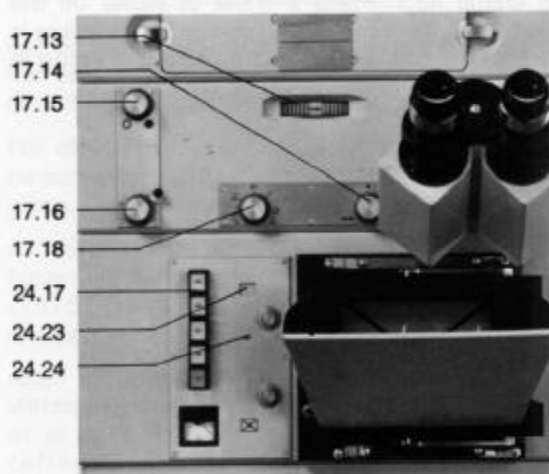
Adjust specimen image according to Sect. 1–3, 5 and 6 on page 42.

Phase contrast without condenser

1. With objectives 16× **Ph** or 25× **Ph** adjust brightfield illumination. Open diaphragm 43.5 on lamp unit.
2. Attach phase plate Ph 1 (475715) or Ph 2 (475716) in place of the phase contrast condenser, see page 43.
3. Set index mark on knob 17.15 to ●. Focus to the luminous image of the stop with knob 17.16.
4. With drive 43.9 adjust the size of the luminous ring to that of the dark one. With the centering screws on the phase stop bring the image of the dark phase ring in the objective to within the luminous ring.
5. Set index mark on knob 17.15 to ○ and view the phase contrast image.



Phase plate 1 (4757 15)
for LD-Planachromat $16\times / 0.30$ Ph
Phase plate 2 (4757 16)
for Planachromat $25\times / 0.65$ Ph and $50\times / 0.95$ Ph



Working with condenser

Mounting light source and condenser

- Switch on light source according to Sect. 1. below, and swing out diffusion disk with knob 43.4 (slot in the direction of the light).
 - Direct light bundle toward a surface about 2–3 m away. Loosen lamp socket with clamp 43.3 and shift until the coil is sharply imaged. Tighten clamp 43.3. Swing in diffusion disk 43.4.
 - Mount light source on extension tube 43.6 on carrier and clamp.
 - Lift carrier with drive 43.9. Loosen clamping bolt at bottom of carrier, and press down spring bolt for insertion of condenser dovetail.
- The phase contrast condenser must be turned to the click stop position.

Brightfield

with condenser

1. Connect lamp unit 60 to the mains via power supply 29.12 and switch on with knob 29.3. The following elements light up: signal lamp 29.7, pushbutton "I" on panel 24.17, and field 24.23 or 24.24.
2. Adjust rated voltage 12V with knob 29.3 on voltmeter 29.2.
3. Direct the entire light flux into the tube:
Beam splitter I (17.13): →
Beam splitter II (17.6): ←
Beam splitter III (17.14): set index mark to ●, and to → for tube 2.
Set zoom OPTOVAR 17.18 to "1", and index mark on knob 17.15 to ○.
4. Set disk on phase contrast condenser to "J", and lower the condenser with drive 43.9 until the field of view in the tube is bright. Open the condenser diaphragm 43.12 and the lamp field stop 43.5.
5. Place the specimen – with the coverglass pointing downwards – on the specimen stage. Swing in a low-power objective ($10\times$ to $25\times$, for phase contrast a Ph 2 objective).

Focus eyepieces on reticle 17.4.

Turn eyepiece tubes clockwise until the crosslines – with the focusing reticle the double lines at the format edge – appear sharp.

6. With focusing lever 29.6 find the specimen image in the tube and focus.

If at the beginning you do not achieve sharp focus with this lever, refocus with the precise focusing 13.4. If the image is too bright, reduce the lamp voltage with knob 29.3 or use a suitable filter.

7. Close lamp field stop 43.5 until its edge becomes visible in the field of view, though unsharp and not centered. Focus on the edge of the lamp field stop with drive 43.9; only then will the image lie exactly in the specimen plane.

8. With the centering screws 43.8 center the lamp field stop image in the eyepiece with regard to its field of view edge. Correct with the drive, if necessary. Open lamp field stop 43.5 until its edge just disappears behind the field of view edge.

9. Set index mark on knob 17.15 to . The image of the objective aperture becomes visible in the eyepiece, and within this image an image of the aperture diaphragm 43.12 and of the lamp coil, provided the diffusion disk 43.4 is swung out. Both images are neither sharp nor centered.

10. Centering the aperture diaphragm:

Close aperture diaphragm 43.12 until its edge becomes visible in the objective aperture. With knob 17.16 focus the auxiliary objective on the diaphragm edge.

With lever 43.10 and knob 43.11 center the diaphragm edge with regard to the objective aperture. Adjust aperture diaphragm 43.12 so that the diameter of its image corresponds to about $\frac{2}{3}$ to $\frac{3}{4}$ of the diameter of the full objective aperture.

11. Centering the light source

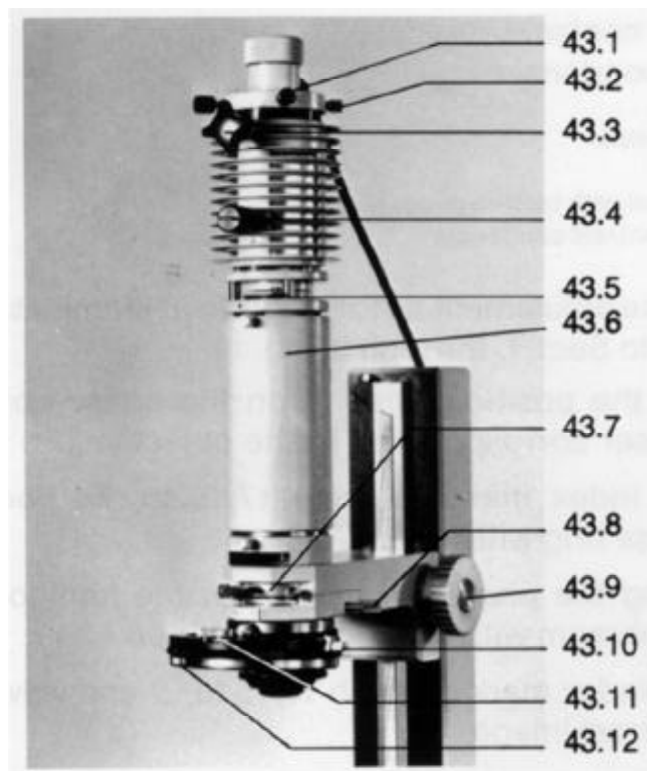
Swing out diffusion disk 43.4. Swing in high-power objective (e.g. 50 $\times$). Focus on the image of the lamp coil with knob 17.16.

Loosen the blank clamps 43.2 of the spring bolts. Adjust the black centering screws 43.1 so that the lamp coil lies in the center above the objective aperture.

Swing in the diffusion disk. Set index mark on knob 17.15 to .

Swing in the objective for observation.

12. Check and/or improve the adjustment after each change of objective or zoom OPTOVAR (17.18) setting.



Carrier 475637 for transilluminator U with lamp unit 60 and phase contrast condenser IV Z/7

- 43.1 Black centering screws for the lamp socket
43.2 Clamps of spring bolts pressing the lamp socket against the centering screws 43.1.
43.3 Clamping screw for the lamp socket.
43.4 Knob for moving the diffusion disk. The diffusion disk is swung in when its slot is in horizontal position.
43.5 Iris diaphragm imaged by the condenser as lamp field stop together with the specimen.
43.6 Extension tube 475638
43.7 Filter openings. Filters of 32 mm dia. are first plugged into rings 467252.
43.8 Centering screws for the condenser
43.9 Drive for illumination
43.10 Lever for centering the phase stop
43.11 Knob
43.12 Condenser (aperture) diaphragm which becomes operative during brightfield illumination (position J).

Phase contrast with condenser

Accessories

Objectives with built-in phase ring
Phase contrast condenser

1. Make adjustment as for brightfield illumination according to Sect. 1. through 8.
2. Set the position (1 or 2) on the phase contrast condenser corresponding to the objective (Ph 2 or Ph 3).
3. Set index mark on knob 17.15 to ●. Focus on the phase ring with knob 17.16.
4. Bring the phase ring to within the luminous annular diaphragm with lever 43.10 and knob 43.11.
5. Set index mark on knob 17.15 to ○ and view the phase contrast image.

Darkfield

Accessories

- | | |
|--------|--|
| 465500 | Ultra condenser 1.2 ... 1.4 for coverglass specimens or chambers with bottoms 1.1 to 1.3 mm thick. With Planapochromat 100×/1.30, darkfield can only be obtained with a plug-in diaphragm. |
| 465505 | Dry darkfield condenser 0.78/0.95 for Planapochromat 25/0.65 |

For both condensers:

- | | |
|--------|--------------------|
| 465542 | Condenser holder Z |
|--------|--------------------|

1. Insert darkfield condenser
Put a bit of immersion oil on to the specimen (bubble free) and lower the condenser with drive 43.9 until it immerses.
2. Make adjustments as for brightfield Sect. 1. through 8.
3. Following objective exchange, focus the image and improve the centering of the lamp field stop image with the screws 43.8.
Add immersion oil (bubble free) on immersion objective, with plug-on diaphragm if necessary.

Working Instructions

Camera

Make image adjustment (image section and image sharpness) through the binocular tube with the aid of the focusing reticle inserted in intermediate image plane 0" at 17.4.

The focusing reticle may be mounted in reticle insert 475770 or in the slider with turret 475771, or with other reticles. In the factory the reticle plane is most exactly adjusted with regard to the two image planes in the camera.

The most precise adjustment of the two eyepieces to the crosslines encircling the image is a vital precondition for correct results following the adjustment through the tube. It is facilitated by double lines pointing outwards in the center of the four sides of the format edge. When adjusting the eyepiece tubes make sure that the double lines are sharp. Before focusing the image for exposure, make sure that the adjustment of the eyepiece tubes remains unchanged.

There are two possibilities **to form the image in the camera** via the observation module:

1)

Beam splitter I (17.13):  according to 19.1.

Without intermediate optics the image is directly produced in the camera. The magnification factor of the observation module is 1×.

Use this adjustment only for very dark specimens to avoid light losses due to intermediate optics.

There is no image in the tube. For focusing the image section

Beam splitter I (17.13) to 

Beam splitter II (17.6) to  (21.2).

Only when the zoom OPTOVAR 17.18 is in position "1" will the correct image section appear within the format edges of the reticle.

After focusing set beam splitter I again to .

If about 20% light loss is acceptable in favor of observation during exposure, set – like in 21.2 –

Beam splitter I to 

Beam splitter II to 

2)

Beam splitter I (17.13): 

Beam splitter II (17.6):  like in 19.2

With the zoom OPTOVAR the image size can be continuously varied between 0.8× and 3.2×. A specific magnification can be exactly adjusted or a specimen optimally fitted in the image field. A light loss caused by the zoom OPTOVAR is unavoidable.

Here, too, there is no image in the tube. It becomes visible when beam splitter II is set

a) to  (see 20.1), or

b) to  (see 20.3)

No image is produced in the camera in position a), but only in position b) or in the basic position according to 19.2:

Beam splitter I (17.13): 

Beam splitter II (17.6): 

To avoid errors, use the following **standard position** for photomicrography:

Beam splitter I (17.13):  like 20.3

Beam splitter II (17.6): 

Operating the camera**4×5" exposure**

1. Slide knob 24.22 to the stop. Field 24.23 must light up.

35 mm exposure

1. Pull out knob 24.22 to the first click stop. Field 24.24 must light up. The opening of the 4×5" camera is closed.

2. a) Push the pushrod 24.14 to the stop for automatic exposure control during integrated exposure reading.

In photomicrography integrated exposure readings supply generally the best results. Use spot readings only when the characteristic object covers only a small portion of the image field and is of extremely high contrast with regard to the background, for instance in darkfield and fluorescence.

- b) For spot exposure reading pull out the pushrod 24.14 to the stop; the symbol 24.15 must light up.

For spot reading swing in the focusing reticle on the reticle slider with turret 17.4 and swing in the reticle with circle index. Move the specimen to bring a specimen portion which is characteristic for the exposure within this circle. Swing in the focusing reticle 17.4.

3. Adjust the speed of the photographic material (white figures for DIN, red figures for ASA) by turning knob 23.7 to the dot index.

The speed changes by a factor of 2 or $\frac{1}{2}$ respectively between two click stops. Smaller intervals can be added or subtracted by turning the ring 23.8.

4. Slide the magazine with plate (or sheet film) behind the frame 24.9. The magazine presses down lever 25.2 which

a) closes the camera shutter

b) automatically advances the frame counter 24.20 by one number. With reset knob 24.21 the counter can be zeroed or set to any desired figure backward or forward.

The corresponding number is recorded during exposure in one corner of the plate.

4. Insert magazine with loaded film (page 48); the green index line must point to the green dot on the camera body. Lock the magazine by turning clockwise to the stop.

This opens the magazine, and connects the film holder with the automatic film advance.

5. The eyepiece tubes are focused on the focusing reticle. Check the correct positions of the beam splitters.
Adjust the image.

6. 4×5" camera: open the magazine by pulling out the slider.

Check the image section and the sharpness in the focusing reticle.

7. Expose by pressing pushbutton A on panel 24.17 or pushbutton A (29.4) on control unit. The exposure is **automatically** controlled.

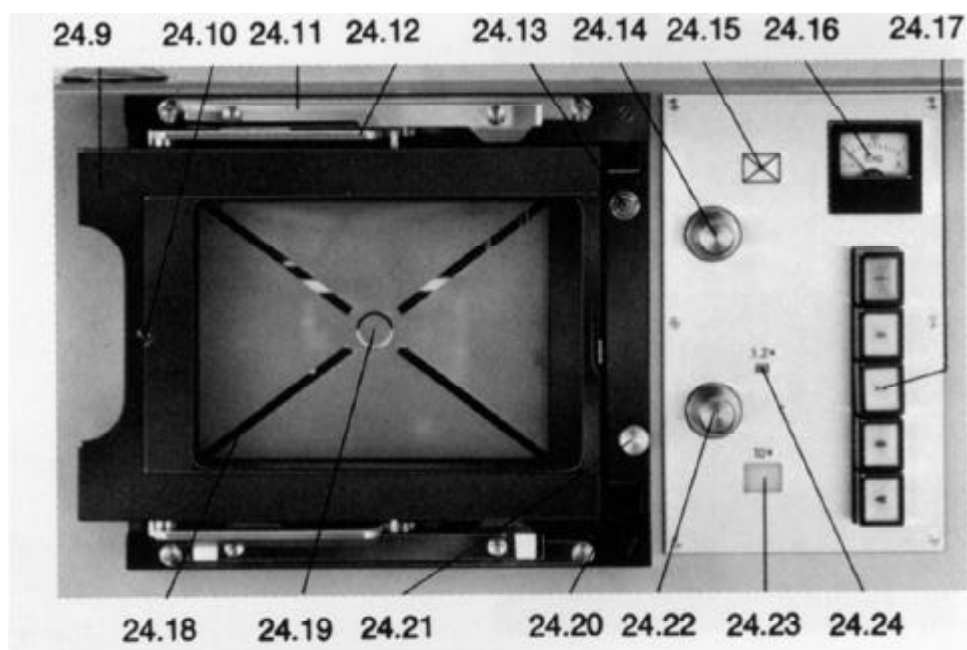
Pushbutton A on panel 24.17 lights up during exposure.

The exposure time can be estimated with the aid of the pointer speed on 24.16 (see page 24).

8. The release pushbuttons are by-passed after exposure by the double exposure lock. Release this lock for a desired double exposure by pressing the red knob 24.13.

Close magazine and remove it. The camera is ready for the next exposure.

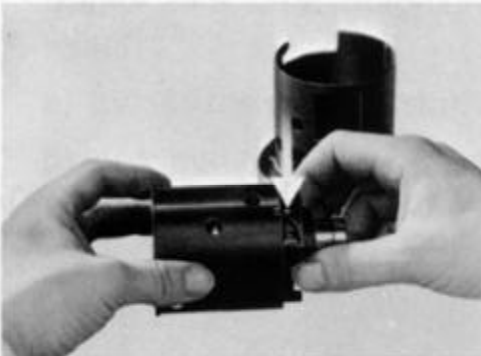
8. The film advance after each exposure avoids double exposures. The camera is immediately ready for the next exposure.



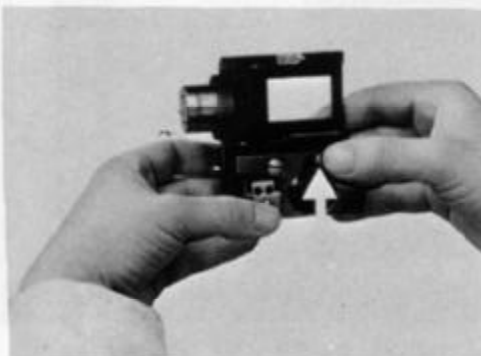
Loading the magazine with a daylight film cartridge



1. Turn magazine in the camera counterclockwise to the stop and remove it. The green index line is provided for re-insertion.



2. Press against the bottom of the magazine, turn the upper part and pull out the interior part.



3. Take out the spool holder. Insert it only when the pin (arrow) engages with the recess of the interior part.

4. Press the slotted knob to open the lid.

5. Insert the film cartridge. Pull the film over the roller with the emulsion on top, until the teeth of the transport rollers engage in the perforation.



6. Guide the film behind the spool and fix in the usual manner. Tighten the film by turning the spool. Close lid and let it engage.



Assemble the magazine, insert into microscope (green index line) and lock by turning it clockwise.

7. Set dial to film type. Make three blank exposures (e.g. with pushbutton B) and set frame counter to "35".

Set dial to film speed.

After exposure:

8. With the crank rewind the film in the magazine. Then open the magazine and take out the film.

